THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LIX. No. 1516.] LONDON, MAY 31, 1892. [44TH YEAR. PRICE 6d.

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BY

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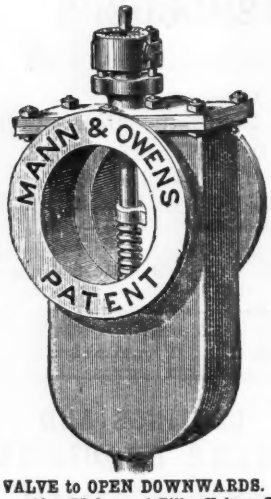

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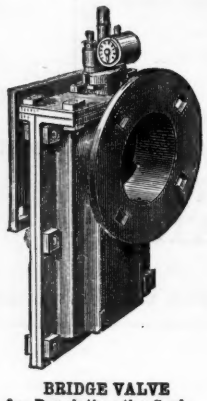

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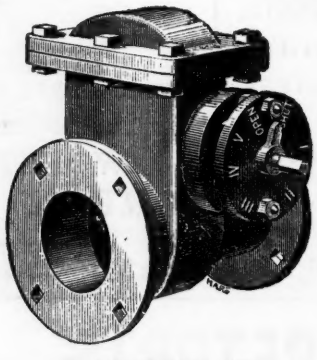

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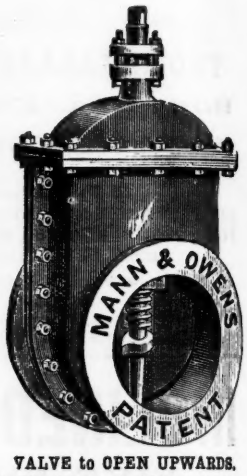

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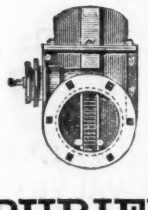

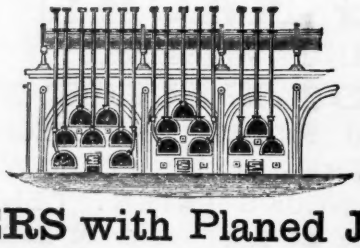

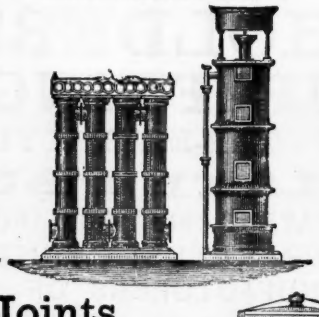

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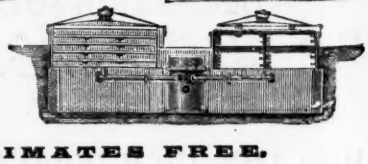

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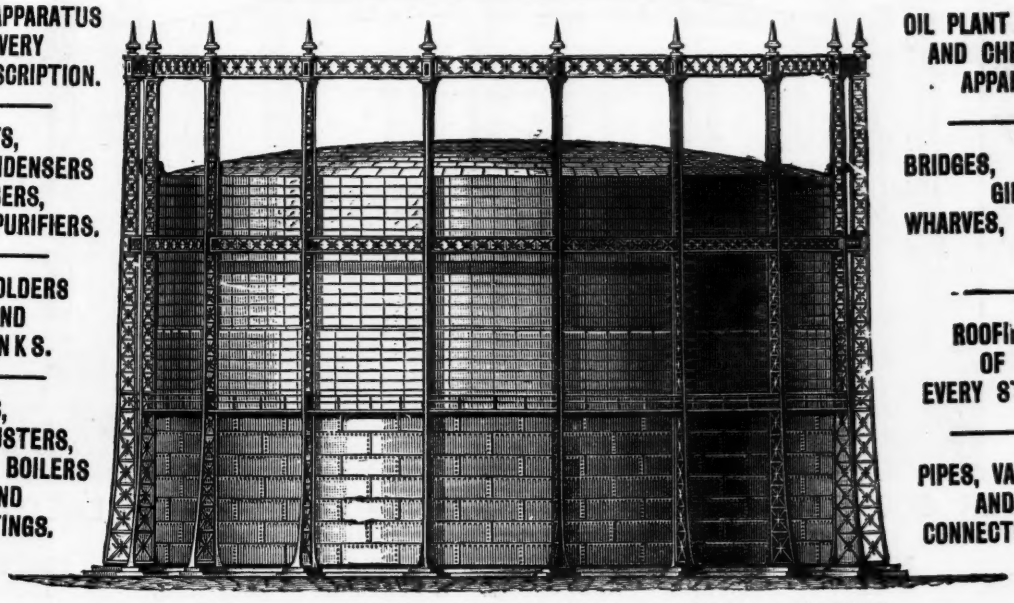

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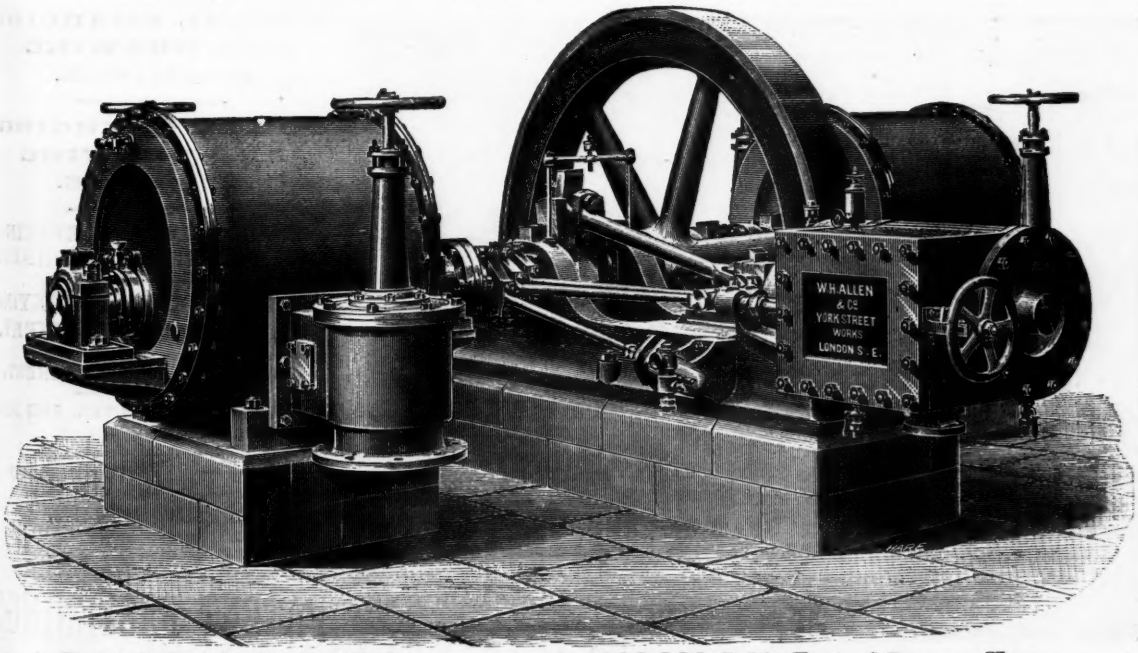

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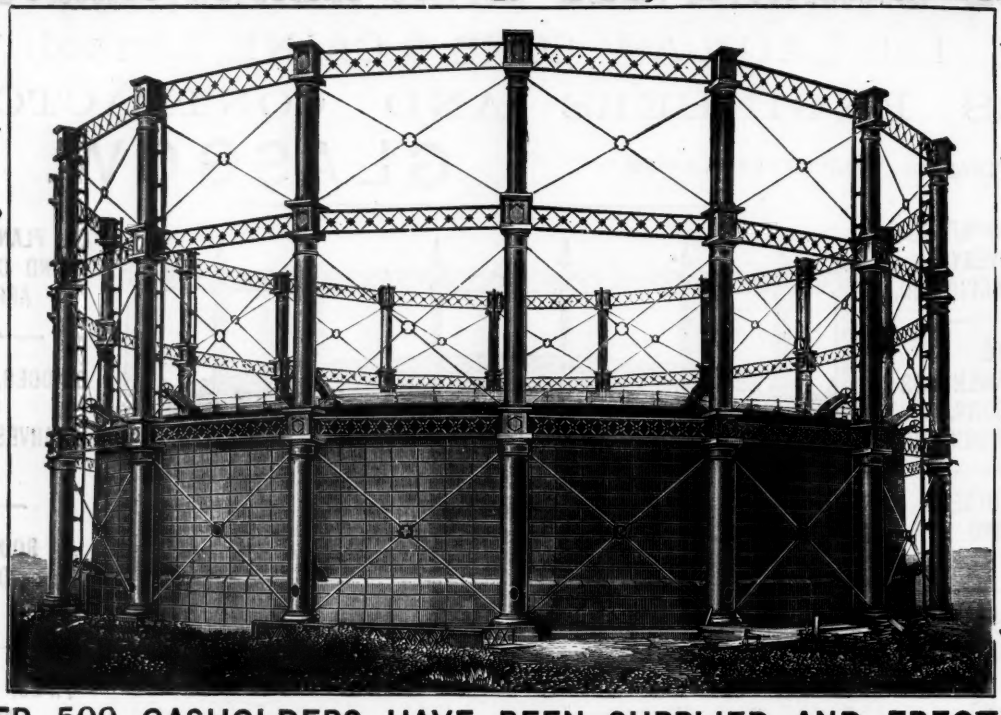

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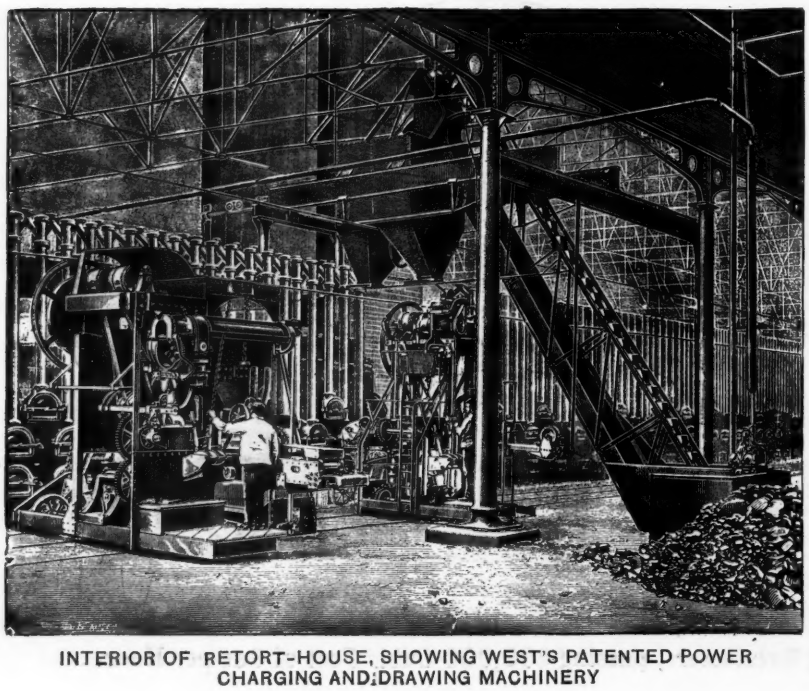

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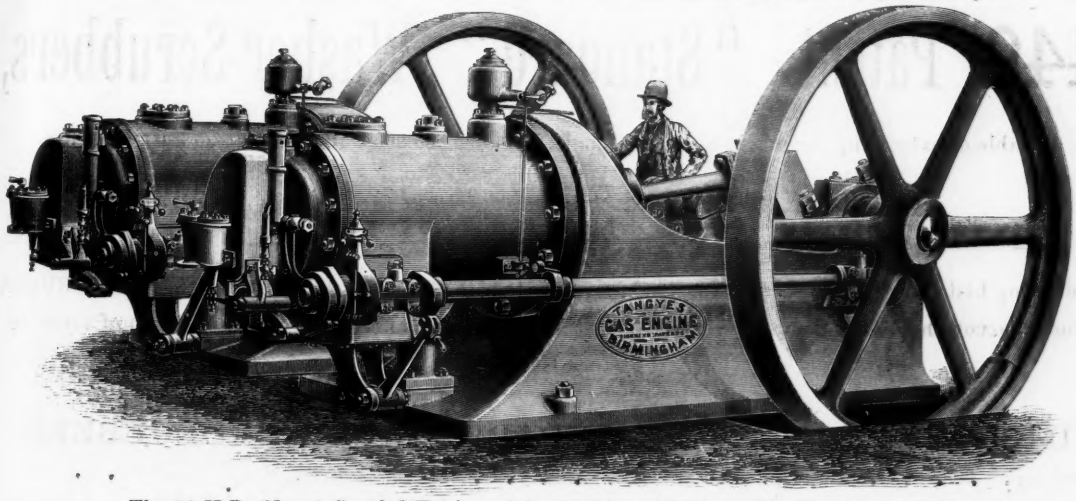

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Capable of extracting the whole of the Ammonia from 426,560,000 Cubic Feet of Gas per 24 hours,

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Kensal Green	3,000,000	Cambridge	1,000,000	Lowestoft	500,000
,,	3,000,000	West Bromwich	1,000,000	Newton-le-Willows	500,000
Liverpool	3,000,000	Luton	1,000,000	Manchester	400,000
,,	3,000,000	Alger (Algieria)	875,000	Erfurt (Germany)	400,000
Croydon	3,000,000	Valencia (Spain)	875,000	St. Chamond (France)	350,000
West Ham	3,000,000	Barcelona (Spain)	875,000	Santander (Spain)	350,000
Rochdale	3,000,000	Nice (France)	875,000	Atlas Steel Works, Sheffield	250,000
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Charlottenburg (Germany)	1,500,000	,, ,,	600,000	Sydney	100,000
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Shoreditch (in part)	2,500,000	,,	1,500,000	Enfield	300,000
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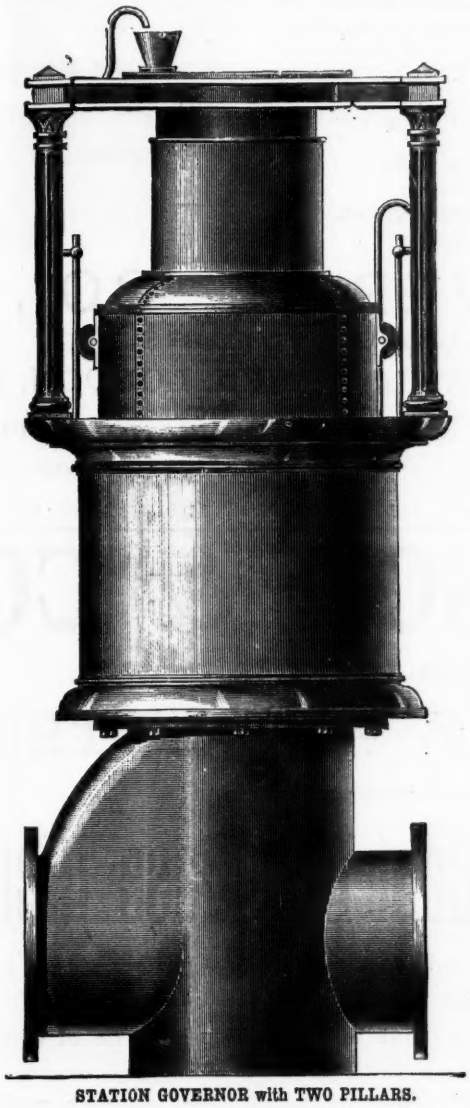
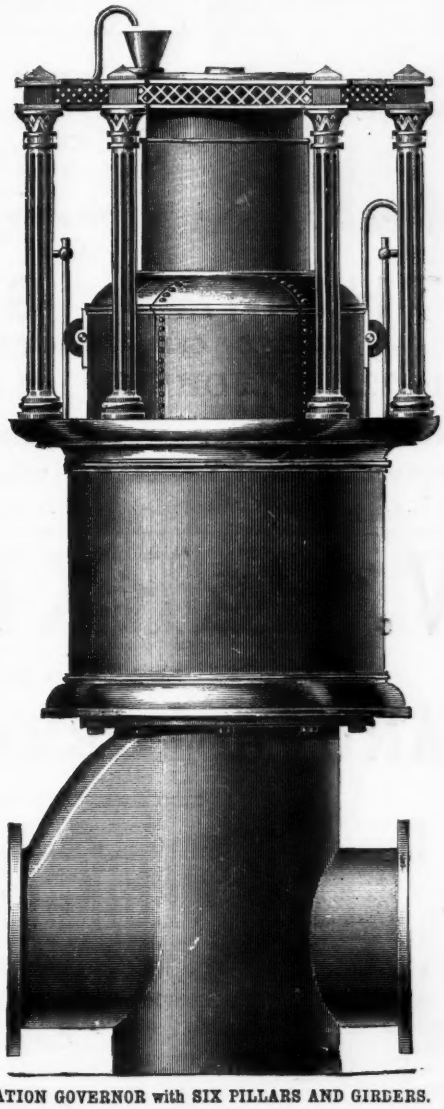
Another and a great advantage is the **unique water-loading arrangement,** which is made perfect and complete by the use of **WM. COWAN'S PATENT "STATIONARY SYPHON."**



STATION GOVERNOR with TWO PILLARS.



STATION GOVERNOR with SIX PILLARS AND GIRDERS.

The water loading is further utilized to maintain automatically the depth of the "seal" in the compensating slide. While the loading is going on, the water is first delivered into the slide, from which it overflows into the loading tank below.

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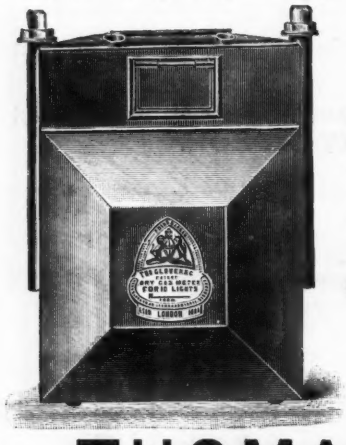

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4th.—Cannot become fixed by Frost, however severe.
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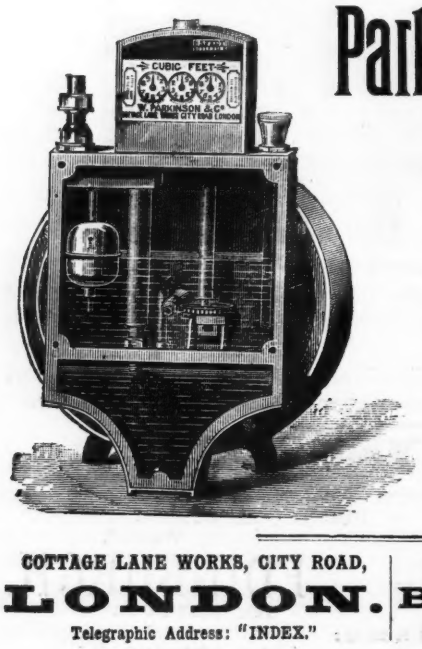

Parkinson's Cast-Iron Case Meter.

Works with very little friction.
Will stand very high pressures.
Cannot possibly be shut off by sudden increase of pressure; the float being affected by outlet gas only.
Allows for loss of water by evaporation without materially affecting the registration or shutting off the gas.
Unexcelled for Simplicity of Construction, Excellence of Workmanship, and Accuracy of Registration.

COMPENSATING METERS,

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BELL BARN ROAD WORKS, BIRMINGHAM. Telegraphic Address: "GAS-METERS."

OFFICE: 10, MAWSON'S CHAMBERS, DEANSGATE, MANCHESTER. Telegraphic Address: "PRECISION."

[See also Advt. p. 1042.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 31, 1892.

The Result of the Gasholder Patents Litigation.

THE judgment of Mr. Justice Kekewich in the notable suit of *Gadd and Mason v. The Corporation of Manchester* was delivered, somewhat unexpectedly, last Thursday. It will be found at length in another column. Its effect, as summed up by the learned Judge himself, is that the plaintiffs' case failed, and the defendants win, with costs to be taxed on the higher scale. Before proceeding to deal with the merits of the matter, we desire to express that natural sympathy with, and commiseration for, the losers, which must be experienced by all impartial spectators of such a well-contested action. The plaintiffs did their very best to win, in the honest belief that they were justified in their proceedings by having both law and right on their side. The case was conducted throughout with consummate skill and perfect temper; and the spite, as of rival tradesmen, which sometimes embitters actions of the kind, was wholly absent. The result is a very serious one for the losers; for the costs of the six days' hearing and of the preparation of the evidence must be heavy. There is this to be said, however—the plaintiffs, while losing their 1888 patent and their suit, do not sacrifice anything more. So far as we can understand the matter, they had not made any use of this patent, and did not appraise its commercial value at any considerable figure. They only work their earlier spiral guiding patent, which was not in question at all in this suit. Their special business interest, therefore, in gasholder guiding remains unaffected. It would have been very different if the real defendants—Messrs. Ashmore, Benson, Pease, and Co., Limited—had lost the day; for it was their business interest which was at stake. They actually deal in the specialty in gasholder guiding which Messrs. Gadd and Mason only claimed to have included in a hitherto unworked patent; and consequently the result of defeat would have been very much more serious to them, from the business point of view. As it is, Mr. Pease's patent remains untouched, even if it is not in a stronger position legally than it previously occupied; and Mr. Pease's firm can go on their way rejoicing in the liberty of making and selling as many wire-rope guided gasholders as they can find customers for, while Messrs. Gadd and Mason must turn for comfort and solace to the proceeds of their spiral guiding patent.

This consideration leads us to the natural reflection that Messrs. Gadd and Mason would have been much better advised if they had not attempted to interfere with Mr. Pease. We say this, not in the spirit of one who is wise after the event, but upon the broad question of what is right, fair, and reasonable as between man and man. It is difficult to see why the plaintiffs in this case should have undertaken to play the part of "dog in the manger" to Mr. Pease, by taking proceedings against the customers of his firm. Surely, there was, and is, room enough in the world for both these specialists; and it is hardly conceivable that Messrs. Gadd and Mason would have suffered, either in cash or in credit, if they had acquiesced from the first in taking the line which has now been forced upon them—leaving Mr. Pease alone, as he was not interfering with them. We have no desire to exasperate the losers' chagrin by moralizing upon their discomfiture to the text of "serve "them right." But it is impossible to shut one's eyes to the facts that Messrs. Gadd and Mason were the aggressors; that they went out of their way to endeavour to stop somebody else's business; that they strained to the breaking-point their privileges as patentees; and that disaster has overtaken their attempt to grasp too much. Well, if they have blundered, they must pay the penalty. "Whoever plays at bowls must expect rubbers;" and for those who put the law in motion for their own ends and come to grief there is but slight sympathy felt in this work-a-day world.

Regarded generally, as a lesson in patent law, this action and its result are most instructive. As we have already had occasion to point out, the nature of these proceedings rendered it necessary for the plaintiffs to satisfy the Court that their patent was good, and that the defendants had infringed it. The infringement was not denied, if the plaintiff's patent could be maintained; but it was contended for the defence that the patent was bad. Three points were relied upon to this effect: First, it was argued that a contemporary inventor—Mr. James Terrace—had published, by letters to various people, who in turn disclosed their contents to others, one form of the invention patented by the plaintiffs, and had consequently rendered it impossible for them to obtain protection for the same thing. This part of the case was separated from the rest. It was agreed that Mr. Terrace's device was identical with one of the plaintiffs' arrangements, and that if Mr. Terrace had published it, in the legal sense of the term, the plaintiffs' patent would be wrecked upon this point alone. But, although Mr. Terrace's conduct, in bestowing his confidences in various and sundry quarters where they were not at all desired, was peculiar, the Court held that his communications did not amount to legal publication. We pause here to draw attention to the trouble and expense which Mr. Terrace entailed upon others by these futile disclosures, and their fruitlessness in regard to his own interests. No man is justified in intruding his notions in this way upon strangers, especially if he has grounds for supposing his correspondents to be personally interested in the subject. Mr. Terrace's communication with Mr. Gadd was particularly

inexcusable; and it is only fair to Mr. Gadd to allow that he did his best to extricate himself honourably from an exceedingly awkward position. It is to be feared, however, that regard for the interest of others will not operate powerfully enough with some prospective patentees to hinder them from forcing their crude ideas upon the notice of men whose position makes them a target for this kind of sport. It is therefore more to the purpose to lay stress upon the consideration that by every such communication the would-be patentee gravely imperils his own chance of obtaining a valid patent. The way to protection is open to all at a reasonable price; and the inventor must take his own risk. It is not competent for him to obtain the opinion of the world upon his notions before "backing" them, so to speak, by payment of the fee needed for provisional protection. After this affair, a prudent engineer will refuse to receive, under the seal of confidence, any communication from a stranger dealing with the subject-matter for a prospective patent.

The second count of the defence was that the plaintiffs had not preserved due conformity between their provisional and complete specifications, inasmuch as the latter had been expanded in order to make it embrace methods of attaining the patentees' object which do not come fairly within the meaning of the terms of the provisional specification. This is the most instructive feature of the proceedings, for outsiders who are or may at any time be situated similarly to the plaintiffs and defendants in this case. The position may be explained thus: The law permits—we will go further, and say it even encourages—an inventor to obtain protection for his invention while it is yet immature, and offers to extend this protection to any natural developments of his idea which may be found necessary or desirable in the course of those trials of the general arrangement which the interval between the lodging of the two specifications is expressly granted to facilitate. But the provisional patentee is not the only person in the world for whom the law has consideration—a fact which the individual is rather apt to overlook while the frenzy of the inventor is full upon him. The law looks sharply after developments of inventions provisionally protected, especially when, as frequently happens, the order of ideas represented by the invention is occupying the minds of many men, and discovery, having its goal in sight, as Justice Kekewich remarked, is hurrying on from all directions with rapid strides to a clearly-perceived end. The first discoverer of a new field may be allowed a considerable range in the selection of his particular claim. But "first discoverer" and "exclusive proprietor" are not the same; and the law is not lightly won over to make the terms synonymous. The "early bird," in the person of the first inventor, usually wants not only his own, but all the worms that can be picked up in the field upon which he has pitched; but the public who are not inventors incline to the opinion that right as well as law are in favour of giving others a chance. At any rate, to drop metaphor, there is good sense as well as good law in the position taken up by the Courts, and now re-affirmed in the clearest way by Justice Kekewich, which is that the matter of a complete specification must be contained in the provisional specification. It is not sufficient that a competent expert can aver that the provisional specification "adumbrates" something which, with later knowledge, the patentee includes in his complete specification. Knowledge grows and spreads fast and far sometimes. There is quite enough as it is, for the public good, of lucky first patentees triumphantly pointing to words and phrases in their provisional specifications to which, in the light of later results obtained by other workers, they are able to ascribe meanings which were not in their minds when the document was drafted. That this is so is notorious. But it is exceedingly difficult to establish the contention in specific cases; for when discovery is going forward from day to day, it is hopeless to fix the meanings of words from one period to another. Callow inventors, and patentees of no small experience as well, are all the better for being reminded of the fact that the patent laws exist primarily for the benefit of the whole community. This is a lesson in generalities; and there is another in regard to detail which may well be mentioned with it, which is this: All means of attaining the same end are not equivalents for each other; and the difference between development and evolution, although undefinable, is apt to come out into overwhelming prominence when the analytical mind of a Chancery Judge is set upon the question of "non-conformity." So Messrs. Gadd and Mason lose upon this crucial point; and, what is even more conclusive than the result when taken without circumstance, they have been defeated through the testimony of their own principal witness.

Upon the third point at issue—the so-called paper anticipations—Mr. Justice Kekewich prudently declined to enter, in view of the effect of his judgment upon the second head of the case for the defence. But what he said about this branch of the proceedings makes at least as much for the defendants as it does for the plaintiffs.

The Final Papers at the Gas Institution Meeting.

In the present issue of the Journal, we give our last instalment of the proceedings of the Incorporated Institution of Gas Engineers at their recent meeting. It comprises the discussions upon the two papers of Messrs. Goulden and Paddon and Mr. Frank Livesey, both of which were valuable in themselves, and the occasion of some very instructive debate. We do not intend to make any comment upon the water-gas paper or the observations which were more or less based upon it. As with the oil-gas and carburetter papers, we think that the matter had better be left where it stands, for everybody interested in the subject to study for himself. The temptation to criticize some of the statements of various writers and speakers is strong; but the process of the elucidation of the truth is so tedious and painful, and so likely to be as greatly helped by some men's blundering as by other men's carefulness, that we shall even stand aside and see the matter threshed out in the various experimentalists' own way. One thing at least may be said here, and it is that, in the course which the British engineers who report to the Institution have set for themselves, the experience accumulated in such portentous bulk by their American brethren is of little or no use to them, either as guidance or warning. Water gas is a commercial product in the States; with us it can hardly be conceived as anything more than a special preparation, offering, under certain conditions, a definite amount of assistance to the coal-gas maker, but not to be sold on its own account. Moreover, it has to be made, if at all, from materials different in many highly important respects from those employed for the purpose in America. There the manufacture of water gas has been created for a purpose, or rather for several purposes, hardly one of which applies to the conditions prevailing here. We have neither the Standard Oil Company nor the Lowe patent whereon to base an artificial success for carburetted water gas; and neither our prices nor our statutes permit of our playing with methods of gas manufacture as the Americans do. They have simply gone on increasing the dimensions of their plant as their trade grew. But of systematic research into principles they have done very little; and it is probable that the two or three British experts who have seriously gone into the water-gas question already know more about the elements of success, having regard to their own circumstances, than could be told them by men who, as a matter of trade, sell the same class of gas largely.

Mr. Frank Livesey's paper was a stimulating contribution to the literature of gas-works construction, and went to show that the possibilities of improvement in the matter of gasholder design are far from spent. It is a healthy shock to preconceived notions to propound the example of a holder composed of six shallow lifts, and show how a difficulty of guiding which would be of recognized magnitude in a holder of one or two such lifts becomes less rather than greater when these are multiplied. The gas engineering world will await with the liveliest interest an authentic report upon the performance of the remarkable structure described by Mr. Livesey, and seen in a partly completed state by the members of the Institution at East Greenwich. It will be quite in order, therefore, if he arranges to furnish a sequel to his paper for next year's meeting, telling how the holder has fared during the winter. Opinion is agreed upon the point that the *crux* of the system which this holder exemplifies will be the proper working, while rising alone, and the accurate cupping of the top or first lift. To all intents and purposes, this lift will be guided mainly from the base by the arrangement of radial and tangential rollers provided at this part of the structure; and if it acts well—of which there is little reason to doubt, so excellent is the workmanship—its success will be a further vindication of principle.

The Programme for The Gas Institute Meeting.

THE programme for the forthcoming meeting of The Incorporated Gas Institute, which is to commence this day fortnight under the presidency of Mr. W. A. Valon, of Ramsgate and London, and be prolonged for the usual period, has been issued by the Secretary (Mr. W. H. Harvey, B.A.). Both Tuesday and Wednesday will be whole-day meetings. The first item of interest in the proceedings will be the presentation of the Birmingham Medal to Dr. Perkin, F.R.S., the discoverer of the tinctorial quality of coal-tar derivatives, who, it is understood, will endeavour to be present in person to receive and acknowledge the gift. The premiums for last year's papers will also be awarded to Professor Vivian B. Lewes, Mr. A. T. Walmisley, and Mr. T. N. Ritson, in the order named. A special feature of Wednesday's business will be the Murdoch commemorative lecture, to be delivered by Professor Lewes, the subject being "A Century "of Work on the Development of Light from Coal "Gas." There will be a reception, to be followed by a *conversazione* and dance at the Westminster Town Hall on Wednesday night. An opportunity of inspecting the chief distributing station of The Gaslight and Coke Company in Goswell Road will be provided on Thursday evening, through the kindness of Mr. George F. L. Foulger. The Friday's excursion will be an up-river trip to Windsor. The customary tale of papers and communications to be submitted to the meeting has been made up as follows: Mr. W. R. Chester, of Nottingham, will treat of the "Structural Capacity and "Cost of Gas-Works." Mr. F. G. Dexter, of Winchester, promises a paper on the "Application of Steam as an "Aid to the Revivification of Oxide of Iron *in situ*." Mr. Thos. Newbigging will read a second paper on "Difficulties "in Tank Construction." In addition to these members' contributions, Professor Lewes will give some "Notes on "the Carburetting of Gases;" Professor W. Foster will recount some "Analyses and Lighting Values of English "Coal Gas made during the Year 1891;" Dr. L. T. Thorne will discourse on the "Influence of Combustible "Diluents on Illuminating Gases;" Mr. A. T. Walmisley will give a paper on "Vertical Standards for Gasholder "Framing;" and Mr. W. Gadd another on "Cantilevers "and Cantilever Gasholders." It is particularly desired that there should be a good attendance at the meeting of donors and subscribers to the Benevolent Fund, which will be held at five o'clock on Tuesday.

Three Excursion Meetings.

THREE District Associations of Gas Managers held meetings last week—the Southern and the Midland on Thursday, and the Manchester on Saturday; and in all the element of pleasure, of the solace of congenial companionship in the open air, outweighed the formal, or the technical and business, element. The Southern organization visited the President, Mr. Andrew Dougall, at Tunbridge Wells. The Midland Association went to Rugby, where the members were received by their popular Treasurer, Mr. Peter Simpson—soon, we are sorry to learn, to transfer himself from the "active" to the "retired" list of members of the gas industry—and after listening to the deferred Inaugural Address of the President (Mr. W. Littlewood, of West Bromwich), and discussing a paper on the Monier system of construction in cement, spent the rest of the day in visiting places of interest in the neighbourhood. The Manchester Institution devoted the day to an excursion to Skipton and Bolton Woods—a notable locality for all Englishmen by whom the rich history of their country is recognized as a precious heritage. By these well-organized trips in the early summer-time, when, if the weather is only propitious, it is a satisfying pleasure merely to exist in the fresh air, and to feel oneself in accord with the ever-renewing energy of Nature, our technical societies undoubtedly fulfil a highly important function of their being. The members evidently think so; for the "out-meetings" are not the least well attended of all the gatherings which break the monotony of the gas manager's year. And even if the benefit derived from mutual association at regularly recurring periods were to be computed upon rigidly technical data, it would probably be found that notes can be compared and experiences exchanged to just as good purpose while driving through a pleasant country, or strolling over an old-world domain, as in a more severely business meeting. It is unnecessary, however, to excuse, upon the score of mere utility, these little excursions, enjoyed for themselves and as opportunities of congenial converse between men who have so much in common in their work and their business cares, that it is easy for them to participate in the pleasant whiling of a few summer hours once a year. It is a poor heart that never rejoices. The gas manager's life is not all made up of difficulties with pipes and machinery and stokers. He has hours when the mention of the gas examiner stirs not his spleen, and when his pet aversion in the town council is powerless to annoy. Such are the hours which, with good health and fine weather to keep him cheerful, he spends with his fellows in reviving memories of the gallant Sidneys, in appreciating the influence of the great Master of Rugby, or in conjuring up visions of "Bolton Abbey in "the Olden Time." Let us sincerely hope that the era may be very far distant when the associated gas managers of Great Britain will be too heavily burdened with the anxieties of money-making for other people, to spare the time for such outings as those to which so many of them, as by common consent, appropriated some of the most shining hours of a week phenomenal in English meteorological records.

Mr. A. P. Trotter's Illumination Photometer.—We are asked by Messrs. Alexander Wright and Co. to mention that the manufacture of the above-named instrument, to which reference was made in the JOURNAL last week, has been entrusted to them; and that they will be pleased to reply to any inquiries respecting it from those who are interested in its use.

The Gas Industry at the Labour Commission.—At the meeting of Section C of the Labour Commission yesterday, the following witnesses were examined in connection with the gas industry: Mr. C. Wheeler, representing Beckton coal porters; Mr. W. A. Valon, President of the Incorporated Gas Institute, who laid before the Commission a mass of statistical information which he had been able to collect from gas undertakings in Great Britain, Ireland, and the Channel Islands; Mr. T. Duxbury, Manager of the Darwen Corporation Gas-Works; and Mr. H. E. Jones, Engineer of the Commercial Gas Company. A report of their evidence will be given next week.

The Albert Medal of the Society of Arts for the present year has been awarded to Mr. Thomas Alva Edison, in consideration of the important services rendered by him to the progress of electric lighting, telegraphy, and the telephone. It may be remembered that this medal was instituted in 1862 as a memorial of the Prince Consort, for 18 years the President of the Society, and is bestowed annually for distinguished merit in promoting arts, manufactures, or commerce. It was first awarded in the year 1864 to Sir Rowland Hill; and among the men of science who have since received it have been Faraday, Whitworth, Liebig, Bessemer, Siemens, Armstrong, Thompson, Joule, Hofmann, and Helmholtz.

A Murdoch Centenary Cot in the Children's Hospital, Leicester.—In conjunction with a movement set on foot by the Mayor of Leicester (Mr. T. Wright) for the support of cots in the Children's Hospital in that town, the employees in the Corporation Gas Department have decided to maintain one. In a communication addressed by the Engineer and Manager (Mr. A. Colson M.Inst.C.E.) to his Worship announcing this determination, he said he should like, the present being the centenary of the discovery and introduction of gas lighting, the cot to be designated the "Murdoch Centenary Cot." This suggestion has been acquiesced in. The cot will cost about £25 per annum, which will be covered by a subscription of about a penny a month from each employee; and the idea was taken up most enthusiastically by the entire staff of the Gas Department.

Iron and Steel Institute.—The annual meeting of this Institute was held on Thursday and Friday last week, at the Institution of Civil Engineers, under the presidency of Sir F. Abel, F.R.S. In the course of his address, the President alluded to the loss the Institute had lately sustained in the death of the Duke of Devonshire, whose Inaugural Address delivered in 1869 he took as the text of his own. He proceeded to indicate the rapid advances which have been made in the knowledge at the disposal of iron and steel makers; pointing out, in particular, the great service afforded to metallurgy by the investigations pursued by Sir Lowthian Bell in various directions. In conclusion, he showed how strikingly the late Duke's address illustrated the progress which has been made in the expansion of the steel industry since its delivery. The examples of the marvellous development in the applications of iron to which the Duke referred, constituted in the present day the directions in which the steel manufacturer had accomplished his most prominent achievements, and in which the use of iron was becoming a memory of the past. Several papers were presented; one on "Platinum Pyrometers," by Mr. H. L. Callendar, M.A., and another by Mr. B. H. Thwaite, of Liverpool, on "Fuel and its Efficiency in Metallurgic Operations."

WATER AND SANITARY AFFAIRS.

Our suggestion of last week, that the most proper amendment for the London Water Bill would be the extinction of all the clauses, was nearly receiving a practical fulfilment on the day when our remarks appeared. The Select Committee on the Bill held their second sitting on that day, and having received further evidence from the promoters, proceeded at once to declare, through their Chairman (Sir Joseph Pease), that they could not at the present time sanction a new Water Authority for London, such as was involved in the constitution of the proposed Joint Committee of the County Council and the Corporation. Of course, the effect of this decision was to shut the Corporation entirely out of the Bill; and, as joint promoters with the County Council, it became necessary for the two authorities to confer as to the course they should adopt. The Corporation had clearly nothing to gain by going on with the Bill; but the County Council had something left—the Committee being of opinion that it might be desirable to give the Council, apart from any other body, the powers asked for to carry on negotiations with the Water Companies and to promote Bills in Parliament. The County Council and the Corporation having taken the decision of the Select Committee into consideration, it was resolved to go on with the Bill, or so much of it as remained. The Committee then proceeded to adopt amendments, enabling the Council to expend £10,000 on inquiries into the water supply, and in the conduct of negotiations with the Water Companies. Power was also given to promote Bills in Parliament. In this form the Committee passed the Bill; and the County Council profess to be hugely pleased with the result, while expressing their condolence with the Corporation at the entire exclusion of that body from any voice or representation in the matter. Should the Bill by any chance fail to get through Parliament, the Corporation will at least have the satisfaction of paying for the cost of its promotion. As the case stands, the County Council have failed in their grand endeavour to become practically a Water Authority under cover of the proposed Statutory Committee. Very much has either been left out of the Bill or struck out of it; and although power to promote Bills dealing with the water supply opens up a prospect for the Council, the actual result will be regulated by circumstances not yet developed. A singular step was taken by the Select Committee, in giving the County Council power to expend £10,000 in inquiries and negotiations, whereas the Council only asked for £5000. This is so much of the ratepayers' money to be expended in fighting the Water Companies; the plea urged by the Council when asking for the £5000 being that the money was wanted in order to put their case properly before the Royal Commissioners, and also to ascertain the legal power and position of the Water Companies. The sinews of war are thus to be provided; and the County Council will not fail to spend up to the maximum. The aspect of the Bill as it affects the Corporation is one which can hardly be acceptable to that body. In future, the County Council will have no need to seek the aid of the Corporation in going before Parliament on the water question; the younger body having abundant resources of its own. The scheme of a Joint Committee is not likely to be revived; and yet we do not know that the Corporation need regret the privation. The semblance of power without the reality is little else than a snare; and this would have been the fate of the Corporation with a representation of one-eighth on a Water Committee owing no allegiance but to the County Council.

The Gas-Testing Arrangements in the City of London.—At the meeting of the Court of Common Council of the City of London last Thursday, it was decided, on the recommendation of the County Purposes Committee, that apparatus to the amount of £300 should be purchased for the gas-testing stations in the City, over which Professor Vivian B. Lewes, F.I.C., F.C.S., as the Corporation Gas Examiner, has sole supervision.

Return of Mr. W. Carr to England.—We learn that Mr. William Carr, who has been for some time in Johannesburg superintending the erection of the works (designed by Mr. T. Newbigging) for the supply of gas there, left the Cape on the 18th inst. on his way to England. He will therefore probably arrive in time to exchange greetings with his numerous friends on the occasion of the forthcoming meeting of The Gas Institute.

THE INCORPORATED INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS, May 11 & 12, 1892.

Mr. Charles Hunt, M.Inst.C.E., President.

DISCUSSIONS ON THE PAPERS.

We complete to-day the report (commenced last week) of the discussions on the papers read at the meeting.

Messrs. Paddon and Goulden's Paper on the Technology of Water Gas.

The President said the paper they had heard was a most interesting and complete one on the technology of water gas. No doubt Mr. Goulden would be glad to answer any inquiries or give any further information in his power. He (the President) would like to ask him if he could say what was the cost of producing water gas.

Mr. W. Foulis (Glasgow) said according to the paper it required from 60 to 80 gallons of water per 1000 cubic feet of gas made for spraying and cooling the hydraulic main. This seemed to him to be a very large quantity.

Mr. Goulden said they were now making 26-candle gas at Beckton, and the cost of manufacturing it—viz., materials and labour—was about 1s. 10½d. No capital or administrative charges were included; but this cost would be reduced shortly, and might be taken as a maximum. In reply to a question by Mr. Denny Lane, he added that different classes of oil were used.

Mr. A. G. Glasgow said he hardly felt that he had anything to add to the paper, to which he had listened with very great pleasure; but there was one point whereon he might make a few remarks—viz., that with reference to which Mr. A. C. Humphreys was quoted, and as to which he could speak authoritatively. He was speaking to Mr. Humphreys less than a fortnight previously; and he might say that, while he was quoted correctly, the paper referred to was written three years ago, and in the last eighteen months there had been a very great advance in the efficiency of water-gas manufacture in America. If Mr. Humphreys were making the statement now, instead of giving 5 gallons of Lima crude oil per 1000 cubic feet, he would probably feel safer in putting it at 4½ gallons. Then it must be remembered that these were American gallons, which when reduced to English would come out to about 3¾ gallons per 1000 cubic feet, for making 26-candle gas. The paragraph in which it was stated that the object in blowing up was to raise all three vessels to the desired temperature simultaneously, and in the shortest possible time, was of the utmost importance. If this paragraph had not contained the last sentence, it would have omitted one of the chief points in the process. It was not so necessary to raise the energy of the generator fuel to its maximum in a short time, as it was to get a certain degree of richness of generator gas, all the energy due to burning which in the carburetter and superheater with no access of air (thus being burned under most efficient conditions) would raise the three vessels to the proper degree of temperature simultaneously. This was the important feature. When it was blown up as quickly as possible, one was apt to get the most economical conditions—viz., that there should be no carbonic oxide escaping from the superheater, and no access of air, but that all the lost energy of the blast should be simply the sensible heat of the final products of combustion, nitrogen and carbonic acid. Mr. Goulden pictured renewing the chequer work every six months. He (Mr. Glasgow) did not find it necessary to actually renew the brickwork; they simply removed it, brushed off the accumulated ash which made it inefficient as a storer of the secondary heat of combustion, and put the bricks back again. As a rule, unless the oil were introduced very carefully—viz., in the form of vapour—during the pre-heating of the small amount of liquid oil that was being sprayed in, the bricks in the top of the carburetter would be disintegrated at the end of six months, and probably one-fourth of them would have to be renewed. He found that, by replacing them by bricks which had been during six months used in

the superheater, they would last very much longer; new bricks being put into the superheaters, where they seemed carbonated to a certain extent, so as to resist the disintegrating action better than new bricks would. He had listened with much interest to the description of the difficulties of utilizing the tar. They had had a great deal of trouble with this in America, although they did not find anything like so high a percentage of water as was mentioned. There was a large quantity—sometimes 40 per cent.; and existing as it did as an emulsion, made it difficult to distil. A great many managers of gas-works did not trouble about that, on account of the high demand there had been for tar, due to the extensive introduction of water gas; so that the tar distillers were glad to get hold of the tar, and did not scrutinize it very much. They sold the tar, and whatever else was in it, and made the best of it. In fact, he had been astonished at the price some of them obtained for this tar, with its 40 per cent. of water. Where the tar was treated locally in the gas-works, it had been found advantageous, instead of introducing water into the hydraulic main and scrubber, to make the seal entirely with tar. In this way, they kept the water out of contact with the gas until all the tar had been deposited; in fact, it was not brought into contact with water at all. There being no ammonia, it was not necessary. The tar was kept circulating—entering at the top of the scrubber, passing through the seal, and out again into a sufficiently large tank to enable it to cool before it came back again. The next question was to what extent the contact of the gas with the tar would reduce its illuminating power; but the best information yet obtained led to the belief that it was not so injurious to the gas as scrubbing it with water. Probably something depended upon the temperature of the tar. Considering a water-gas apparatus as a heat-engine, and looking at the oil handled as so much iron turned on a lathe, the whole energy required for the production of gas was furnished by the generator fuel. Now the energy of the fuel was distributed and applied entirely by the energy of the blast; so that of all the problems that entered into the manufacture of water gas from that point of view, regarded as a heat-engine burning so much coal, it was of the highest importance to get the apparatus in the first place designed so that it would permit of blast conditions most economical to the manufacture of gas. Having had this done, it was equally important that those conditions should be maintained in practice. Roughly speaking, it depended to a great extent on the relative size of the carburetter and superheater; because in them was stored up the heat applied to the oil. The other question of importance was the proportion between the diameter and the height of the fuel-bed in the generator, which varied very materially with the fuel used and the pressure of the blast in the generator; this difference being the difference in pressure on the top of the fuel-bed and below it. It might be interesting to know that, of all the gas made in the United States and Canada during the past year, upwards of 60 per cent. was carburetted water gas, including not only the independent water-gas plants where it was made exclusively, but also plants auxiliary to ordinary gas-works. On taking a recent trip to the Pacific Coast, he found that the water gas made in San Francisco was produced exclusively from oil, at 3½d. per gallon, and from Welsh anthracite coal. The Pacific Coast being so remote from their own anthracite regions, it made it economical to procure from Wales coal costing $9, or 36s. per ton. The reason water gas was adopted in a place like that was because coal gas could not compete with electric lighting, which was there making a tremendous advance.

Mr. C. E. Botley (Hastings) said that Mr. Goulden had given the cost at 1s. 10½d.; while in the abstract he gave the number of gallons of oil used as nearly 5½. He should like to know the price of the oil, because it seemed to him to leave a very small margin for labour and fuel. In the experimental tests, he presumed that the oils were cracked up in water-gas plant.

Mr. F. Livesey said he had hoped Mr. Springer, who had been putting up an apparatus at the South Metropolitan Gas-Works, would have been present, as he would have been able to discuss the paper much better than he (Mr. Livesey) could. With reference to the labour required, it was no doubt exceedingly small. The principal item was the oil. He should like to ask Mr. Goulden if he had tried crude oil, because every halfpenny a gallon reduction in the price of the oil would make a considerable difference in the cost of the gas. He should also like to know if it was necessary to use such a large quantity of water in the hydraulic seal and scrubber. It seemed to be the best way in which to mix up as much water as possible with the tar; in fact, the tar was nearly all water. Mr. Glasgow had referred to working without any water; and he should be glad to know if this could be done. The water was used principally for cooling; so that, if a proper condenser were used, this large quantity of water would not be required. There was nothing but a carbonaceous smell in it; and it was of no value. The gas as it was now being made left the scrubber at a temperature of 150° Fahr.; and there being no condenser beyond the scrubber, it went into the equalizing gasholder at 140° Fahr. It was then pumped out and forced through the purifier into the working gasholders.

Mr. Foulis asked if it was measured at that temperature.

Mr. Livesey said it was not. The quantity was calculated at 60° Fahr. Mr. Springer at first had some doubts about using ordinary gas coke; but he had not found any difficulty there, and was as satisfied with it as with anthracite coal. He also had a plan which he had published for alternating the steam blast; sending it upwards through the fuel for two or three blasts, and then inverting it, and blowing downwards—thus preventing the accumulation of clinker.

Mr. Lacey (Pimlico) said he noticed in the paper that the quantity of steam admitted must be most carefully adjusted; an insufficiency limiting the volume of gas made, and an excess causing the production of a large percentage of carbonic acid. No doubt this was a very important point. He should like to know if the quantity of water vapour in the gas from the producer had been estimated, because it was quite possible there might be an excess of steam under the most favourable conditions; and it was very desirable to know whether or not there was any excess, and what it was. It was evident that it was of the first importance that the producer should be so worked as to give a small amount of carbonic acid in the gas. That being so, unless the quantity of oil were adjusted to suit the heat given off when blowing up for the production of the water gas, how would it be possible to economically use the whole of the heat up to the point where it was coming from the superheater? Of course, he was taking into consideration the temperature at which it must be maintained. Loss did not necessarily follow, though carbonic oxide was going out of the superheater; and if one had heat enough to do the work, he could not do more.

Mr. Paddon (Beckton) said there was very little left for him to say, especially as Mr. Glasgow had satisfied him on so many points on which he had been in a condition of doubt. He did not think any subject of leading importance had been left untouched in the discussion; but he could not quite follow Mr. Lacey's remarks. He seemed to anticipate the presence of aqueous vapour in the finished gas.

Mr. Lacey: No; in the water gas. There might be an excess of steam under all conditions.

Mr. Paddon said the only deleterious effect of an excess of steam, if the fire were in anything like a state of efficiency, would be the proportional presence of carbonic acid; and of course, this was always objectionable. If the paper emphasized the importance of keeping this at the lowest possible figure, which could only be done by close attention to the condition of the fire, it would serve a most useful purpose. A remark had been made that gas coke was as good as anthracite coal. He had had no experience of working the latter; but, from the very high percentage of carbon it contained, he could not imagine gas coke, under any circumstances, being so favourable for the purpose of water-gas manufacture, because coke was always varying. The percentage of ash varied; and this was a most important matter. Then there were other constituents. There was always a certain amount of slate; and if the energy of the fire was impaired, as it must be by the presence of any such inert constituents, great difficulty would necessarily be experienced in working without allowing the carbon dioxide to rise to an undesirable percentage. Where anthracite could be obtained, he thought anyone with a long experience of water gas would avail himself of it. They had to put up with gas coke, because they had no other; it was a matter of convenience. But if they could get a better form of carbon as easily and cheaply, they should use it at once. He imagined that the carbon from retorts would

afford perhaps almost the ideal fuel for this purpose. Anyhow, the carbon efficiency of any fuel constituted its greatest claim to consideration.

Mr. Denny Lane asked if Mr. Goulden had formed any estimate of the price at which non-carburetted water gas could be produced.

Mr. J. Methven (Beckton) said the paper was probably written some time ago, at a time when they were at the height of their trouble with the water in the tar. He was happy now to be able to correct this. The tar had accumulated to a large extent on the works; and the mere fact of standing for some time in a large tank had caused a considerable quantity of the water to separate—so much so, that the last lot sent to the tar-works for distillation was considered perfectly satisfactory.

Mr. Paddon said Mr. Glasgow had suggested the circulation of a certain amount of tar or tarry water through the seal. This had been carried into effect at Beckton; and the clean water supply had been almost completely withdrawn from the scrubber and from the seal, and a fixed quantity of soiled water was circulated round and round—thus obviating the use of the very large amount of water which was previously employed. He did not think Mr. Springer could claim priority for his method of alternating the steam and air blast from the top to the bottom of the generator, as he imagined Mr. Humphreys had made that a feature of one of his forms of apparatus.

Mr. Goulden said that he had already replied to the question as to the cost. As to the large amount of water mentioned in the paper, as Mr. Methven had stated, it was correct at the time the paper was written. This, however, was some time back; and by the use of the circulating arrangement Mr. Glasgow had suggested, they were able to bring the water figure down to 4 gallons per 1000 cubic feet, and possibly another 2 gallons for additions to the scrubber, which would make a total of about 6 gallons per 1000 cubic feet. The reason they wasted a little producer gas by blowing away from the stack-valve was probably because they were using coke instead of anthracite. They had to blow more air through the coke to get it to the proper state of incandescence for decomposing the steam. It was, perhaps, hardly correct to speak of renewing the bricks in the superheater and carburetter. They renewed some portion of them; but the rest were simply treated as Mr. Glasgow had himself suggested, by brushing off the ash. With regard to the price of the oil, they were paying from 2¾d. to 3¼d. per gallon, and were now using about 5¼ gallons per 1000 cubic feet. All the oils used had been tested, to find out their maximum value, in a special apparatus, not in the water-gas apparatus at all. They had taken every means to satisfy themselves of the real maximum value of the various oils. They had used crude Russian oil, and were in consequence kept in a constant state of misery for about six months. They had hardly put it in the plant before they found the whole of the brickwork blocked up; and they had to be continually burning and blowing out the apparatus. It was quite impossible to use crude oil—at any rate, if it contained such a percentage of pitch as that they had tried. The difficulty with the water was disposed of by circulation, which would be applicable to the Springer apparatus just the same as to the Lowe. In fact, the Springer was simply a Lowe apparatus; the only difference being that the superheater and carburetter were put on the top of the cupola. Mr. Lacey had made a remark about steam going forward towards the end of the run. There certainly was a little, but only a small percentage, which was hardly material. If the fuel-bed were kept at a proper state of efficiency, and the steam cut off at the point where the fire began to lose its proper degree of heat in the generator, very little steam would go forward. As to the cost of water gas alone, he should think, roughly speaking, it might be reckoned as 5d. to 6d. per 1000 cubic feet.

The President, in closing the discussion, expressed regret that time had not permitted of a longer debate on the very interesting paper before them, for which he would move a cordial vote of thanks to the authors.

This was carried by acclamation.

Mr. Frank Livesey's Paper on the Six-Lift Gasholder and Tank at East Greenwich.

The President said they had kept till the last a paper which, judged by the standard of the originality of the work it described, and probably also by the magnitude of interest it would evoke, was the most important one on the list. It was not necessary to enter very fully into a discussion of it then, as the members would have an opportunity of inspecting the work that afternoon; but if anyone wished to ask any questions on the particulars involved, he was sure Mr. Livesey would be most pleased to answer them.

Mr. Trewby asked if Mr. Livesey could tell them what saving was effected by carrying the two lifts above the standards. No doubt, in designing the holder, this must have entered into his calculation. Of course, there would be a saving in the cost of the standards for the two lifts; but against this must be put the additional strengthening of those lifts.

Mr. Denny Lane inquired if the figures given included the cost of the tank.

Mr. Livesey replied in the affirmative.

Mr. S. Glover (St. Helens) asked if the roof was untrussed; and, if so, how it was intended to support it.

Mr. C. Gandon (Sydenham) said he had always admired the combined system of radial and tangential rollers, which he thought was right, especially for large gasholders; but he did not know how it might work when they were alternated, as he understood was being done with the holder in question—the lifts having alternately radial and tangential rollers. All would watch with great interest the result of the two top lifts rising without any framework. There were instances of holders erected without any guide-framing at all; but they were only small ones. This would be the most interesting instance, on account of its being the largest holder yet built. As to whether the plan would work as satisfactorily as it had done with smaller holders, he would not like to express an opinion; but it seemed to him that greater strength must be needed, not only in the bottom curb, but also in the plating of the holder, to enable it to resist the strains that would occur on the sides.

Mr. Foulis asked whether the guides were opened out at the top, so as to enable the pulleys to enter freely. It struck him that if the rollers had any chance of missing the guides, the consequences would be very serious.

Mr. Livesey replied that they were tapered off to a certain extent to receive them. There was about 6 inches play to allow the rollers to come into their places.

Mr. Gandon said he understood there was some special arrangement made to prevent any danger from tilting on account of the shallow lifts.

Mr. T. May (Richmond) said they were much indebted to Mr. Livesey for the description he had given them; but they would be able to criticize it better after seeing the holder. As Mr. Gandon had remarked, having so large a holder as the one in question with two lifts to go out, was quite a new departure. The only thing which struck him as being open to criticism was the width of the top girder, which was only 22 inches; and as the usual Paddon ties were dispensed with, it seemed to him that it was not sufficient to keep the framing steady. With the holder in the Old Kent Road, before the Paddon ties were put on, the framing used to sway about in the winter; and it seemed to him that this top girder, instead of being only 22 inches, ought to be several feet wide.

Mr. R. Morton said he was very much interested in the holder, and some of the difficulties mentioned, and the questions asked, had occurred to him. But it went without saying that all these things had been very fully considered, or the holder would not have been in course of erection. Mr. Foulis was a little mistaken in asking if the guides were opened out at the top. He would see that they required rather to be tapered off, because the wheels did not come in between them, but outside. With regard to the guiding of the inner lift, which was the *crux* of the whole question, it was very clearly shown on the drawings before them. He thought the top carriage ought also to have a radial roller, as the main strain would come at that point. They were working, as it were, on two inclined planes on a wedge; and a very great strain would come there, which would be obviated by putting in an additional radial roller. Without that, with the two angular rollers at the top and three at the bottom, he did not see how the holder could possibly rise otherwise than level. This being so, when once it was cupped they had the 62 feet, which would ensure the rest of the holder going perfectly level.

Mr. Foulis said it had sometimes occurred to him that, in a large structure of this kind, the difference in the

diameter of the holder in winter and summer would be considerable—probably as much as ¾ inch. The effect of this would be to alter the guiding of the holder, especially when there were a great number of wheels, as in the present case. He should like to know whether this point had been considered.

Mr. BOTLEY asked if the space behind where the rollers worked in the guide-path was filled up at all; and, if so, how it was reached in order to preserve it.

Mr. W. W. WOODWARD (Bromley) congratulated Mr. Livesey on the ingenuity of his arrangement. He said it seemed to him that the difficulty would have been obviated if he had adopted the Gadd and Mason system on the two lifts; and it would have materially improved the appearance of the holder, by doing away with the two long horns standing out, which he was sure, if they had it in a district like Bromley, would be the subject of a great amount of criticism.

Mr. LIVESEY, in replying upon the discussion, said, in answer to Mr. Trewby, that he could not at the moment give the figures he asked for; but he would add them to the paper for the Transactions. The only difference was that, by allowing the two lifts to go out of the framing, additional stiffeners were required in the inner and second lifts; and the saving would be the top lengths of framing dispensed with, and also the erection, which was a considerable part of the cost. The holder was not trussed; in fact, it would be a difficult matter to truss a holder of this kind. It was a defect in the paper that no description had been given of the internal framing; but it could be seen, and any omission could be supplied by inspection that afternoon. With reference to tilting, a scheme had been thought out; but nothing had been done, as it was believed that the present arrangement of rollers would be sufficient. In reply to Mr. May, he might say the top girder was a very strong member of the structure. The large angle gusset-piece connecting the two girders from one side to the other of the standard, really made it exceptionally stiff. As to the difference in winter and summer, if the holder decreased in diameter in winter, the framing would do the same. It was a fact that, in the first holder put up with flat diagonal bars, if they were riveted up at six o'clock on a spring morning, when the temperature might be 35° Fahr., at midday, with the temperature at perhaps 70°, they were certainly rather slack. If the frame expanded, the standards must tilt over a little. The difficulty was, however, more imaginary than real. With reference to the Gadd and Mason principle, it might answer very well if the holder did not rise far above the houses; but those who had been on the top of a holder when there was only a light wind blowing below, and found it was almost a gale above, would agree with him that, if they were to allow the whole of this part of the holder to go up without framing, the bottom lift would have to be made so excessively strong that as much would be lost by this as would be gained by doing away with the framing. In reply to Mr. Botley's question, the back of the roller path was filled up with concrete. He could only say, in conclusion, that, on seeing the holder, the members would be able to form better opinions of its merits than they could by a description of it.

The PRESIDENT said they would be able to resume the discussion in the afternoon; and therefore all he could now do was to propose a vote of thanks to Mr. Livesey for his description of the holder. As Mr. Morton had remarked, the *crux* of the whole thing was in the guiding of the inner lift; and they would all watch with intense interest the results of this most important experiment. If it proved as successful as he had little doubt it would do, there was scarcely a limit to the extent to which one might go in the capacity of gasholders. If six shallow lifts answered, six deep lifts ought to be made to do the same; and there would be no reason why the next gasholder should not be double the capacity of the one they would shortly inspect at East Greenwich.

The remaining business at the meeting has been already reported (*ante*, p. 896).

Queen's Birthday Honours.—Among the honours conferred by Her Majesty on the anniversary of her birthday, we notice that Lord Balfour of Burleigh (Chairman of the Metropolitan Water Commission) is to be a member of the Privy Council; and that Mr. Courtenay Boyle, Assistant-Secretary to the Board of Trade, who was associated with his Lordship in the important inquiry on railway rates, is to be a K.C.B.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1028.)

TAKING everything into consideration, the markets have made very fair progress during the past week. Speculative business continues rather shy; but purchases for investment are stil largely in order. As a result, prices of pretty well everything worth buying, have risen to a moderate extent. A slight check was experienced when it was found that the settlement would involve one or two operators in difficulties; but the influence hardly extended outside the special market affected. The Money Market continues in the same overloaded condition; there being scarcely any employment for the superabundance. The Gas Market has shown only moderate activity; and movements are somewhat irregular. The chief feature is the continued improvement in the value of high-class secured issues for investment purposes; while the ordinary stocks, on the other hand, are decidedly easier. In Gaslights, the "A" has receded three points; transactions falling gradually away from 212 on Monday to 207½ on Saturday. The debenture, preference, and limited issues were brisk and in good demand at improving prices; the "C," "D," and "E" advancing 1; the "H," 1½; and the 4 per cent. debenture and "B," ½ each. South Metropolitan were weaker; but business was limited. The "A" receded 5; and the "B," 2. Small business was done in Commercials at rather better than average figures. Among the Suburban and Provincial undertakings, hardly anything was dealt in except Brentford, the old shares of which have risen 2 more. Bromley also improved ½. The Continental companies remained quiet; and the tendency is still towards easier prices. The only fall marked was a loss of 2 in Imperial Continental. The rest exhibit little change. Buenos Ayres regained the ½ it lost the week before; and Chicago first mortgage bonds improved 2. In the Water undertakings, a few transactions were marked daily; but, on the whole, they were quiet. Changes are few and slight; but all are in the upward direction, except West Middlesex. Grand Junction are going to pay a dividend of 8½ per cent. Twelve months ago they dropped from 9 to 8 per cent.; so they now recover half the lost ground.

The daily operations were: The market was rather quiet on Monday; and the tendency was somewhat downward. Imperial Continental and South Metropolitan "A" and "B" receded 1 each; but Gaslight "B" rose ½. Southwark Water rose 1. On Tuesday, the principal issues were still flat; Gaslight "A" and Imperial Continental losing 1 each. Chicago First Bonds rose 2; and Buenos Ayres, ½. Gas was extremely quiet on Wednesday. Movements were irregular. Gaslight "A" fell 2; but ditto "C," "D," and "E" rose 1; ditto "H," 1½; and Brentford old, 2. West Middlesex Water fell 1. Thursday was more active, and changes were few. South Metropolitan "B" fell 1; but Gaslight 4 per cent. debentures rose ¼. In Water, Kent rose 2½; Southwark, 2; and East London, 1. On Friday, the only feature was a fall of 2 in South Metropolitan "A." Saturday was as quiet as usual, and changes were few; the only moves being an advance of ½ in Bromley, and a fall of 2 in South Metropolitan "A."

ELECTRIC LIGHTING MEMORANDA.

Another Metropolitan Electric Lighting Company—The Disadvantages of Ship Electric Lighting—The Difficulties of Electrical Traction—Electric Lighting and the Fire at "Scott's."

ANOTHER Metropolitan electric lighting venture was put upon the market last week; the name being "The Electricity Supply Corporation, Limited," which is about as indeterminate a title as could well have been selected. There really ought to be some rule in this matter of the nomenclature of electric lighting speculations, unless confusion is to reign in the technical and financial worlds respecting the question of identity. After a while there will be sore grief over the difficulty of distinguishing by their names between companies solvent and the opposite, and between concerns fresh from the promoters' hands and others safe in the hands of the Receiver. Now this name of the Electricity Supply Corporation has a familiar sound; it also shows a lordly scorn of local restriction. Yet the venture is a fresh one, and its sponsors have no wider horizon than the boundaries of the parish of St. Martin-in-the-Fields. Nay, it is as yet far from occupying all this area, being merely an amplification of an installation originally put down for their own purposes by Messrs. A. and S. Gatti, the well-known *restaurateurs* of the Adelphi. The district may be a good one for the extension of the electric light; and the Company may do as well as others of the same order (which is not saying very much); but £170,000 in shares and debentures is a good deal for Messrs. Gatti's little enterprise, even with its new and comprehensive name.

The extended use of electric lighting on board ship is one of the most certain gains of this system of lighting. One has grown quite accustomed to say, as though the matter were beyond argument, that the electric light is a conspicuous success for passenger and war steamers. But from some of the remarks of Lieut. F. T. Hamilton, R.N., in the course of a

lecture recently delivered by this officer at the Royal United Service Institution, upon the present condition of electricity in the navy, it appears that the very free employment of electric light on board Her Majesty's ships is not unattended with some drawbacks. It must be admitted that electric lighting is very popular on board ship, as it may well be when its only rival is the dingy and smelly oil-lamp; but the officers whose duty it is to watch over the development of ships as a whole are becoming uneasy with regard to the great quantity of machinery required for so much electric lighting as is now deemed almost indispensable for modern craft. It has already come to this, that a vessel of the *Latona* class requires about 5 tons of coal per week to keep her electric lamps going. This not only costs a great deal of money, especially when the ship is on a foreign station, where coal is dear, but there are other considerations upon the same head; one of them being the striking fact that the space occupied by a week's coal supply for the electric lighting would hold candles enough to last the ship for six months. Again, while the incandescent lamps are very nice in the ship, it is by no means agreed by all naval authorities that the showy "search-lights" are likely to be of much real use in war time. On the whole, therefore, it must be admitted that electric lighting is not an unmixed good, even in the place which it seems to suit best.

There appears to be little present prospect of the electrical engineers entering upon that wide inheritance of railway and tramway traction which they confess would pay them so much better than anything they can hope to do by lighting. They talk about electrical traction and the transmission of power by electricity as among the certainties of the future. But it is always "the future;" and the promised triumph continually keeps moving a little farther off, like the foot of a rainbow as we approach its apparent resting-place. The fact that electrical tramways do run in the United States, and in a few localities in this country, does not appear to advance the general solution of the problem. Our English cases of electric traction are essentially sporadic, and nobody seems to think of it when new lines of tramway are being laid down under ordinary conditions, where electricity would have to take its chance among other equally available systems of car propulsion. One of the main difficulties, besides the initial one of a suitable disposition for the current conductor, is the enormous disproportion between the effective power (say) of horses, and of the electrical mechanism necessary to do the same work. Our contemporary the *Electrician* puts the question thus: "Why do you want two 15-horse power motors to do the work of two horses?" but without eliciting a satisfactory reply. The incomprehensible genius of Electricity must be feminine; for to all such inquiries she only answers, "Because you do!" which is conclusive, but not convincing. It is a fact that, in order to start a tramcar, which a couple of horses can do with a little effort, 20 or 30 electrical horse power must be available. And when the same proportion is maintained in the case of a train of railway carriages, it is easy to see why electrical traction fails to take the place of the steam locomotive.

There was a fatal fire the other day at a well-known supper-house in the Bohemian quarter of London; and in the course of the inquest it was suggested that an investigation of the electric lighting arrangements of the premises might explain the mystery of the origin of a fire which was otherwise unaccountable. Accordingly, the inquiry was adjourned for this purpose. But when the expert appointed to the task came to present his report, it transpired that there was not sufficient evidence for the conclusion that the electric light wiring caused the outbreak. It is not wonderful that the ruins of a house which has been gutted with fire should fail to furnish evidence of the existence at some anterior period of a "short circuit;" for fire has a way of wiping out all but its own record, and escaping electricity, unlike petroleum, leaves no odour behind. The Middlesex Coroner, however, was not at all satisfied with regard to the innocence of the electric lighting arrangements in this particular house; and he dropped expressions on the subject serious enough to engage the attention of householders and insurance offices. We are not going to strain the evidence further than the Coroner and his jury felt themselves in duty bound to act upon it; but the incident is deserving of notice as one more example of the groundlessness of the claims occasionally put forward by electricians for the perfect harmlessness of their system of lighting.

The Russian Petroleum Wells.—The total amount of crude petroleum oil obtained at Baku during the past year was 4,670,000 tons, of which 4,086,000 tons were piped to the refineries. The quantity of refined oil produced was 1,176,000 tons; and the proportion of this amount exported from Russia was 607,000 tons. At the end of 1891 the number of producing wells was 315; being an increase of 77 on the number at the end of 1890. The increase in the production of the crude oil was about 20,000 barrels per diem. During 1890, prices rose as high as 2s. per barrel; and the average for the year was about 1s. 3d. Last year the highest price was about 1s., and the lowest 2½d., which was much under cost. The producers did not, therefore, benefit by the increased output; and a few small failures were the result. The shipments so far this year give promise of a further increase in export.

PHOTOMETRIE A LA FRANCAISE.

At this time, when so much is being said and done about photometry, it is particularly desirable that those who are interested in the subject should keep abreast of the contemporary developments of the science and practice of light measurement; and for this reason we have to draw our readers' attention to the publication of Dr. Palaz's work,* which is practically a collection of the author's articles that have appeared since 1887 in *La Lumière Electrique*. Thus, while it must be borne in mind that the motive of these writings was the need felt by French electricians for instruction in a branch of applied optical science, with which they had no concern before they began to undertake practical lighting, the matter which Dr. Palaz has brought together, may perhaps be profitably studied by a wider circle. We therefore propose to give a general description of this work, of which our electrical contemporaries have spoken favourably, in order that our gas engineering readers may form their own opinions respecting the extent to which the Lausanne Professor has added to the general stock of information relating to the measurement of lights and lighting.

The book begins with the inevitable theoretical chapter, which is neither better nor worse than others in earlier text-books. We notice that the author ascribes the derivation of the "law of the cosinus" to Lambert, in 1760. For the rest, this chapter, although comprehensive, is anything but easy reading. Dr. Palaz remarks, after Masson, that "the eye is incapable of appreciating more closely than 0·01 the equality of lighting upon two contiguous surfaces, even when the tint of the two lights is the same." This is the limitation of the exactitude of photometric measurements. The author repeats many interesting spectroscopic observations upon the effects of different lights. The second chapter deals with photometers, which are divided into four classes, according to the principle governing their design. Dr. Palaz ascribes the common Rumford photometer to Lambert; as he does what is more generally recognized as the Keplerian law already mentioned. He states that it is not a very exact apparatus; but for rapid determinations of illuminating power to within 10 or 15 per cent., the shadow photometer may be regarded as "very precious," on account of its extreme simplicity. Bouguer's photometer is described as the oldest. The modern Foucault instrument is only a simple modification of it. These photometers are made by the Continental Meter Company, of Paris. They have the inconvenience of requiring the two lights to be on the same side of the screen; but by the use of mirrors, Ritchie has altered this. It was with a modified Foucault photometer that M. Violle carried out his experiments to discover the absolute standard unit of light, which was so enthusiastically adopted, and so unanimously neglected. Dr. Palaz next describes what he calls "relief" photometers; and he then deals with the Bunsen form of the apparatus, which he admits to be the most generally used in industrial testing—especially, he says, in Germany. Of the fact that there are probably ten photometers upon the Bunsen, or grease-spot principle in use in the United Kingdom to one in Germany, Dr. Palaz is apparently profoundly ignorant. He probably does not read English technical publications to any extent, or we should have seen some recognition of the supreme design and workmanship of English photometer manufacturers, which is recognized all the world over—excepting, apparently, in Lausanne. He knows something of what pure experimenters like Sabine, or Ayrton and Perry, have suggested; but if asked how and by what means photometrical work is really done in the United Kingdom and the Colonies, or even the United States, our author would be found wanting. At the same time, he is a mine of information respecting out-of-the-way photometrical notions; and he can tell us all we want to know, and more, about Weber, and Tœpling, and Arnoux, and half a hundred more of the same brand. He describes and illustrates several remarkable instruments, designed for photometers, which we confess to never having heard of—such as the Lion photometric balance, the registering photometer of Dessendier, and so forth. These, of course, are mere curiosities; and in noting their existence, Dr. Palaz is careful to point out the theoretical character of most of them. We know of no such book for curious lore of this kind.

It is a striking illustration of the author's want of grasp of the practical side of his subject, that, in introducing his chapter upon photometrical standards, he merely says that Bouguer used the candle as a standard; and he immediately passes on to mention other standards without saying anything about the extent to which the candle is actually employed for this purpose. Like that of so many French *savants*, the knowledge of Dr. Palaz, though profound, is restricted in range. He seems to know what he does know so thoroughly, that one regrets he does not know more. Yet with all his limitations, this author has much that is instructive to say about candles and lamps, and he draws the sweeping conclusion that "there is not in general, for any combustible whatever, a definite relation between the material burnt and the light produced." For his information respecting candles, Dr. Palaz relies principally upon Herr Kruss.

* "Traité de Photométrie Industrielle," par A. Palaz, Docteur-ès-Sciences. Paris: G. Carré, 58, Rue Saint André des Arts; 1892.

He also mentions Heisch and Hartley, Dibdin and Williamson; but he is not very familiar with the work of the English photometrists. We do not complain of this; for we should not recommend anyone to go to a French author for instruction concerning the doings of M. "Methwen," as Dr. Palaz calls the well-known gas engineer and photometrist. What we should look to a foreign writer for is information respecting foreign work; and this our author supplies in abundance. Among other things, he describes in great detail, and essays to defend, the Violle unit; but he does not say he has ever used it.

Altogether, the book of Dr. Palaz should certainly be found in the library of every British photometrist who aims at a general knowledge of his art, and does not restrict his studies to the "Instructions" of the Metropolitan Gas Referees. It would not have hurt Dr. Palaz, by the way, if he had known something about these intensely practical and matter-of-fact directions to photometrists. The book concludes with a scholarly chapter upon "Lighting."

NOTES.

The Calorimetry of Fuel Gas.

Dr. E. G. Love has contributed to the *School of Mines Quarterly* (of America) an article upon the valuation of fuel gas, in the course of which he states the case for and against the separate distribution of non-luminous combustible gas intended solely for fuel purposes. He admits that the results of the efforts that have been made in this direction up to the present time are not encouraging. The gas has generally been odourless; and although sold at a low price, its calorific value has been low in comparison with that of illuminating gas. Dr. Love remarks that its cost is the only drawback to the use of illuminating gas for fuel. Tests made with the carburetted water gas supplied by the Consolidated Gas Company of New York, have demonstrated that this product possesses an average calorific power of 721 heat units per cubic foot. Similar tests of mixtures of coal and water gas made by other branches of the same Company, give an average value of 694·7 heat units per cubic foot. Dr. Love takes the calorific power of the common coal gas of London at 668 units per cubic foot; and states the price at about one-half that of gas in New York. A large number of fuel gases tested by Dr. Love gave a calorific power of from 184 to 470 units per cubic foot, or an average of 309 units. All Dr. Love's calorimetrical experiments are made with Hartley's apparatus—of which he speaks very highly, as a simple, convenient, and sufficiently accurate appliance for the purpose. He explains the apparatus and describes its use, giving as an example a specimen test of the gas supplied by the Municipal Branch of the Consolidated Gas Company, which is shown to possess a calorific value of 725 heat units at 60° Fahr. and 30 in. barometrical pressure.

The Silent Combination of Oxygen and Hydrogen.

Some interesting experiments with regard to the silent combination of oxygen and hydrogen have been conducted by Prof. Victor Mayer and Herr Askenasy, who have published their results in *Liebig's Annalen*. The object of the experiments was to ascertain whether there is any connection between the time element in this phenomenon and the quantity of water produced; and the main result of the tests has been to answer the question in the negative. Some important observations were, however, made during the course of these experiments. It was found that, when a quantity of the pure dry mixture of two volumes of hydrogen and one volume of oxygen was sealed up in a glass bulb and heated in a bath of the vapour of phosphorus pentasulphide, the temperature of which (518°) is such as to render the bulb slightly luminous, no explosion occurred, but a small proportion of the gases silently combined, with production of water. Upon immersing the bulb in a bath of boiling stannous chloride, which has a temperature of 606°, explosive combination instantly occurred. It was surmised therefore that the temperature at which the explosion takes place lies somewhere between 518° and 606°. But upon modifying the experiment in such a manner as to allow a slow stream of the gaseous mixture to pass continuously through the open bulb, it was found that no explosion ensued under these conditions at the temperature of boiling stannous chloride; although at this temperature the bulb glows with a cherry-red heat and the glass is quite soft. It is thought therefore that the extra pressure of the gases in the closed vessel determines the explosion. The irregularity of the rate at which the silent combination proceeds would appear to be due to differences of the condition of the inner surfaces of the vessels containing the gaseous mixture. When the bulbs are silvered inside, the silent formation of water occurs at temperatures several hundred degrees lower than in unsilvered glass bulbs. Finally, it was found that bright July sunshine is incapable of inducing the combination of hydrogen and oxygen, even when it is concentrated upon a bulb traversed by the gaseous mixture and heated to 606° in a bath of boiling stannous chloride.

Certain Peculiarities of the Electric Arc.

Some instructive observations upon the light of the electric arc were made by Mr. A. P. Trotter, before the recent meeting of the Institution of Electrical Engineers. It was stated, among other things, that, assuming the light to be due to the luminous crater formed in the carbon, the brilliancy of this is as much as 75,000 candles per square inch. The light developed at the St. Catherine's Point lighthouse has been called 6,000,000 or 7,000,000 candles; but to give this, would require an area of luminous crater of about 1 square foot, whereas in point of fact the mean area of the crater is 0·2087 square inch, as determined by Mr. Trotter in a series of twelve projections taken at half-minute intervals. He takes the candle power at about 16,000. The difficulty is in getting the light out of the carbon arc; for unless the points of the carbons are close together the arc is very irregular, and yet this close approximation shuts up a great deal of the light actually produced. If the lower carbon could be dispensed with, and its shadow thereby eliminated, "there would be an overpowering illumination, which would make street lighting much more irregular than at present, unless very high posts were used." Mr. Trotter says that "the nominal 2000-candle power, which 10 ampere arc lamps are sometimes supposed to give, is a perfectly unjustifiable convention; and has been very properly characterized as a 'fine old crusted lie.'" He remarks that, since the ordinary opal globe surrounding an arc lamp does not appear to differ greatly from a uniformly luminous sphere, the candle power at different angles should be very much more uniform than it is with the naked arc; but this is not the case. Mr. Trotter mentions with approval the suggestion of M. Crova, that the portion of the spectrum lying near line 582 gives a true measure of the total candle power; since for a considerable range of temperature, the ratio between the different intensities of this part of the spectrum is practically identical with the ratio of the candle power of two lights.

Grand Junction Water Company.—Subject to audit, the Directors of this Company have decided to recommend a dividend at the rate of 8½ per cent. per annum on the ordinary share capital.

Silver Plating for Gas-Fittings.—The great drawback to the silver plating of goods to be exposed to an atmosphere containing even a slight trace of sulphur is the difficulty of keeping them bright. The sulphur combines with the silver, and forms a sulphide of silver, which has to be removed by means of polishing powder before the silver is restored to its natural brightness; and this cleaning causes the rapid wearing away of the silver plate. The London Metallurgical Company, Limited, of 80 and 81, Turnbull Street, E.C., have introduced a new system which they call "Arcas" silver plating. "Arcas," we learn, is silver alloyed so as to harden it; and this prevents it tarnishing so severely. It is claimed for it that it has every appearance of silver, is cheaper, and no powder is required to clean it; it is capable of being deposited to any required thickness in an adhesive form, and is impervious to moisture; it is far more elastic than nickel, and 25 per cent. harder than silver; and it is suitable for iron, steel, German silver, brass, and Britannia metal. Specimens which we have seen of work done by the process certainly look very beautiful, and appear to be durable; so there should be a good field for it in the coating of such articles as gas-brackets, chandeliers, lamps and reflectors, water and electrical fittings, and the metallic parts of meters.

Making Water-Tight Work Below Water-Level.—A correspondent of the *Engineering Record* dealt with the above subject in a recent communication; the work in question being the construction of some brick reservoirs. The ground was sandy, and the flow of water was very strong; causing much trouble in making the work water-tight. The bottom of one reservoir consisted of an inverted arch built on concrete, and the water forced its way through the concrete before it could be set. On laying the courses of bricks, there was the same trouble; the water breaking through the joints before the cement mortar could set. To overcome this, a thin layer of mortar was spread over the concrete, on which a layer of tarred roofing paper was placed. The first layer of bricks of the inverted arch was laid on this paper; beginning in the centre, and working both ways. When the sides of the reservoir were reached, the tarred paper was turned up, and afterwards built into the wall, until it was carried above the water-line. The bottom was not fully water-tight after the first course had been put in, although the flow of water was very nearly stopped. The process was therefore repeated between the layer just put down and the one following; perfect tightness being thus secured. In another small reservoir, the bottom consisted of concrete, which, when laid, was made tight, except at one place. After the concrete had been put in, the reservoir walls were built; the water which came in through the opening in the bottom being constantly pumped out. When the walls were finished, the whole was left undisturbed for some time, with the water standing in the reservoir, in order to give the concrete a chance to harden thoroughly. The reservoir was then pumped out; and it was attempted to stop the leak in the bottom—first with strong mortar, then with pure cement, and then with plaster of Paris. Finally, a mixture of oakum and cement was tried; but it proved equally inefficient. At last a suggestion was made to drive a tube in the opening, just deep enough to catch the water coming in. This was done, and a common suction-pump was hitched on. The scheme of thus keeping the water from rising proved entirely successful.

TECHNICAL RECORD.

MIDLAND ASSOCIATION OF GAS MANAGERS.

Meeting at Rugby.

More than the usual amount of business was transacted at the "out" meeting of the members of the Midland Association of Gas Managers, which was held at Rugby on Thursday last, under the presidency of Mr. W. Littlewood, of West Bromwich. In compliment to the respected Treasurer of the Association (Mr. Peter Simpson), there was a large gathering of members at the town with which he has been connected—not in gas matters alone—for the past 38 years, and which connection, it was a grief to all attending the meeting to learn, is now so soon to be severed.

On assembling in the Board-room of the Gas Company an hour before noon, light refreshments were served before business commenced. On taking the chair, Mr. Littlewood called upon the Honorary Secretary (Mr. C. Meiklejohn, of Oldbury) to read the minutes of the last meeting, which, it may be remembered, the President was prevented by indisposition from attending, and so his Inaugural Address had to be deferred, and was the next item on the *agenda* for the present meeting. Mr. Littlewood's address (as given below) was well received, and was followed by a paper by Mr. P. Hutchings, on "The Monier System of Construction, and its Adaptability to Gas Engineering Work." The paper, with a report of the discussion to which it gave rise, will appear in due course. Meanwhile, it may again be mentioned that this Monier system was pretty exhaustively dealt with in the JOURNAL for Dec. 8 last year (p. 1035).

At the close of the meeting, a short visit was paid to the far-famed Rugby Schools, and the many historical spots in and about the buildings and grounds were inspected with very keen interest. In conveyances kindly provided by Mr. Simpson, the party then enjoyed a lengthened drive through some of the beautiful lanes surrounding the town—finishing up by a visit of inspection to the works of the Newbold Cement Company and the Rugby Cement Company. For the convenience of the management of these two establishments, half of the members visited each place. The preparation of the cement, and the various methods adopted in testing its strength, occupied a considerable time; but this was certainly not the least interesting part of the day's proceedings. The courtesy of the proprietors in permitting the inspection, having been duly acknowledged in each case, the parties returned to the Gas Offices to dine there on the invitation of Mr. Simpson. As host, Mr. Simpson was in the chair, supported by the Secretary and one of the Directors of the Company; Mr. Littlewood occupying the vice-chair. After dinner, a short toast-list was gone through—the principal item being the "Health of Mr. Simpson," proposed by his old friend Mr. W. North, of Stourbridge, who feelingly alluded to the approaching retirement of Mr. Simpson from active participation in the management of a gas undertaking, and assured him that he would have, in his retirement, the pleasing reflection that he had always been regarded with the utmost esteem and respect, not only by the members of the Midland Association, but also by the gas engineering profession at large.

MR. LITTLEWOOD'S ADDRESS.

Gentlemen,—Permit me to thank you for the unexpected honour you conferred upon me when you elected me to the position of President of your Association. I can assure you of my high appreciation of your kindness; and I am not unmindful of the responsibilities and onerous duties of the office. At the same time, I could have wished that the honour had been conferred upon some one better qualified to fulfil those duties. However, having accepted the office, it shall be my endeavour to carry out those duties to the best of my ability, and with credit to the Association. All I ask from you is that you will lend me your valuable aid in making the year of my presidency as instructive and interesting as those in the past have been, by submitting papers upon various subjects of interest to all.

I have no doubt the past year has proved a very trying and anxious one to most of you; for what with the maintained high price of coal, the higher rate of labour in the retort-house, and the reduced value of residuals, happy is the manager who has been able, in the face of all these, to show a profit on the year's trading without having to advance the price of gas. The coal market at the present time is in a very unsatisfactory state; and the maintained high price is, I am afraid, mainly due to the present unsettled condition of the labour market, which is being kept in a state of agitation arising from such an "unhealthy" cause as will ultimately rebound to the discomfiture of those responsible for it.

Then, again, there are the concessions made to the men employed in the retort-house, which I would not mind so much if they would take interest in their work, which I fear is not done in many instances, since the eight-hour system was introduced—at least, I have noticed this in my own works, and I have been told by my brother managers that they have experienced the same thing. This state of things ought not to be, if the men would but remember what it has cost the shareholders or ratepayers, as the case may be, to make these concessions. Indeed, there is no class of labour that has had such advantages given them, which in many cases have so increased the cost of producing gas as to have made all the difference between profit and loss on the year's trading; and in many cases where the price of gas has not been advanced or maintained at a high price, it has necessitated a draw upon the reserve fund to enable them to meet their obligations.

It must be admitted that, under the old system of drawing and charging, and sometimes in retort-houses where the walls were so close to the mouthpieces that there was hardly room for the man to get his rake in the retorts, the work of a stoker was no light one, and must have been very unhealthy and trying to the most robust constitution. This being the case, it becomes our duty to make the work as light as possible. In many works this has been met by the introduction of inclined retorts, mechanical stoking-machines and manual stoking-machines, by the aid of which considerable saving of labour is effected, with greater ease to the men and considerable advantage to the employer.

This question of labour has become a very serious one, not only to ourselves but to all the other branches of trade. Why there should be this embittered antagonism between (let us say) capital and labour, when each depends so much upon the other, I am at a loss to say definitely. What I should like to see is a closer and more friendly relationship between the two, which if happily effected, when petty disputes arise they would be settled in a more friendly manner than at present, with an absence of that bitterness which is now displayed.

I trust that the Labour Commission will see their way to formulate a plan upon which all disputes affecting the large classes of labour may be submitted to a kind of Board of Arbitration, thereby preventing these ill-advised strikes and lock-outs, which unfortunately lead to so much personal suffering and life-long struggles with poverty and distress, but seldom to a satisfactory settlement of the question in dispute.

There is one solution to this question, which to my mind is the best so far. I refer to the mutual benefit or profit-sharing system as adopted at the South Metropolitan Gas-Works, and which so far has given every satisfaction to all parties. I do not know whether this plan has ever been tried by any of our municipal authorities; but, of course, special powers would have to be obtained before it could. These, however, might easily be obtained; and afterwards it would only be a question of finance. At present I am not prepared to say how such a scheme could be got to work in works belonging to our local authorities; but I do think that the consideration of such a subject, as applied in gas-works belonging to a town, might with advantage be made the subject of a very interesting paper for discussion at a future meeting. I throw out the suggestion with a hope that some member will give the matter his serious consideration with that view.

With reference to the present standards of light, as generally adopted throughout the country, I see that, so far as London is concerned, there is a prospect of there being an alteration in the immediate future, which, if carried out, will no doubt affect us sooner or later; and whatever becomes the standard for London will be the same for the provinces. However that may be, I wish the Committee appointed by the Board of Trade every and speedy success in arriving at a standard which shall be satisfactory both to the manufacturer and the consumer; for the present one is by no means all that could be wished.

Where the illuminating power of the gas is (say) from 16 to 17 candles, it is difficult to maintain an absolutely uniform quality without the judicious admixture of an enricher—cannel being the material most generally in use for the purpose, though I see that some engineers have been using oil for this purpose, with, I am informed, varying results. From experiments made by myself in the use of oil as an enricher, I have come to the conclusion that it is very difficult in ordinary working to maintain the uniform temperature necessary to give satisfactory results; for either the retort is too hot and the oil is converted into solid carbon, or if not hot enough it is not converted into a permanent gas. As a consequence, it would be condensing in the mains, and the mixture would be very irregular in quality. I once had an amusing confirmation of this. I had sent up to London for repairs, &c., one of our jet photometers; and the firm were so long in returning it, that I wrote them a rather sharp letter. Upon this I received an explanation to the effect that there had been some delay in the setting and adjustment of the scale, owing to the gas supplied to the factory being very irregular in quality, due to the gas company in question using oil for enriching.

In conclusion, gentlemen, there are many subjects which I might have taken up your time by remarking upon; but all of them have been so often referred to that I have found some difficulty in avoiding what might be considered but repetition. I trust we shall have no lack of papers which may lead to interesting discussions, and a mutual interchange of experience.

The Proposed New Electrical Term.—It appears that the word "kelvin" will not be introduced into the Electric Lighting Provisional Orders of the present session, to represent the Board of Trade unit, as was recently stated; Lord Kelvin having given the Board certain reasons against its use. He says that, in scientific statements, the words "supply unit" will perfectly distinguish from all others the particular unit intended.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The members of the above Association held their annual excursion meeting at Tunbridge Wells on Thursday last, under the presidency of Mr. Andrew Dougall, Engineer and Manager of the Tunbridge Wells Gas Company. The bulk of the party assembled at the Charing Cross Terminus of the South-Eastern Railway. The Honorary Secretary of the Association (Mr. J. W. Helps, of Croydon) had made special arrangements for the trip; and they were successfully and punctually adhered to throughout the day. On arriving at Tunbridge Wells, the members and their friends found breaks in readiness to convey them to the gas-works, which were inspected under the guidance of the President, and of several of the Directors of the Tunbridge Wells Gas Company, who, together with the Secretary (Mr. John Read), made the visitors heartily welcome to their handsome establishment. The works, as is generally known, were for many years under the control of the late Mr. R. P. Spice, as Consulting Engineer, who has left in the various buildings some enduring monuments of his broad policy and constructive skill. The consumption of gas is rapidly increasing in the district, and the liberal provision for expansion allowed by Mr. Spice is already taken up. Enough was seen at the works to show that, in the President of the Association, the Directors of the Company have an Engineer who is bent upon making the very best use of the opportunities for improvement which a growing business offers to a progressive Manager.

After the gas-works had been thoroughly inspected, luncheon was served in a marquee on the grounds attached to Mr. Dougall's residence; the hospitality of the Directors of the Company being duly recognized, in the name of the Association, by Mr. W. A. Valon, President of the Incorporated Gas Institute, who, with admirable brevity and directness, proposed a vote of thanks to them, which was acknowledged by the Chairman, Mr. W. H. Delves. The kindness of Mr. John Read, who had taken upon himself much of the responsibility of arranging the programme of the day, was also acknowledged.

Leaving the gas-works, the party had an enjoyable drive to Penshurst Place, the historic home of the Sidneys; and having, by the kind permission of Lord de l'Isle, inspected the interior of this most interesting house, whose very walls are eloquent with English history, they partook of high tea together at the Leicester Arms Hotel, in the village, preparatory to the return drive to the town.

The weather was all that could be desired; and the day proved to be one of the most enjoyable in the annals of the Association. Great credit for the unequivocal success of all their arrangements must be given to the President and the Honorary Secretary, who certainly deserve the best thanks of their colleagues for the treat they provided on this occasion.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

On Saturday last the members of this Institution held their annual holiday meeting. This year Bolton Abbey, near Skipton, was the rendezvous; and some sixty members and friends availed themselves of the opportunity of visiting or re-visiting the lovely scenery of Wharfedale. There was a large muster at Victoria Station, Manchester, where two saloon carriages were attached to the 9.25 a.m. train for Skipton. Considerable additions were made to the party *en route;* and others, including the President (Mr. Charles Armitage, of Lancaster), joined it at Skipton. Lunch was served at the Devonshire Hotel. This over, there was a very brief business meeting. First the minutes of the last meeting, held at Manchester in February, were read and confirmed. Then a new member—Mr. Geo. R. Pickering, of Cheadle, Staffs.—was elected, on the proposition of Mr. S. S. Mellor, of Northwich, seconded by Mr. T. Duxbury, of Darwen. This was all the business; and the party immediately made their way to the waggonettes which were awaiting them, and proceeded to Bolton Abbey. The weather proved fine, the drive was delightful, and the scenery in the vicinity of the Abbey most lovely. The journey was so arranged as to take in the most notable features of the district; and in a walk of about a mile from the Strid to the Abbey, the members passed through a scene of sylvan beauty which could scarcely be surpassed. The drive back to Skipton was made under pleasant conditions; and after partaking of tea at the Devonshire Hotel, it was time to think of the train home. Altogether, it was a most enjoyable day. The arrangements for the comfort and convenience of the party were perfect; and for this, credit is due to the Secretary (Mr. Mellor), the President, and one or two other gentlemen.

The Public Health Act and London Fog and Smoke.—We have received a copy of a pamphlet (published by Messrs. Crosby Lockwood and Son) dealing with the above subjects, by Mr. H. G. Assiter. It consists of an amplification of the paper read by him before the Balloon Society on New Year's Day, and briefly noticed in the JOURNAL at the time. An appendix has been added, with a few remarks on the smoke question; and suggestions are offered for carrying out some of the provisions of the Public Health Act which came into operation at the commencement of the year.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

"Decremental Rate of Increase."

SIR,—As your editorial explanation in regard to the above phrase is essentially a repetition of statements which were traversed by my letter to you of the 20th inst. (*ante*, p. 968), I hope you will allow me to place upon record this further protest against them. I cannot have been "wrong in ascribing the formula to Mr. G. Livesey," for the simple reason that I did not so ascribe it, in the sense you suggest. Nor is it true that I placed my own interpretation upon it, as you state. The fact remains that Mr. Livesey did, in 1887, advocate a voluntary reduction, in certain cases, of the standard scale of dividend, which he called, in all seriousness, and, so far as I can see, with perfect propriety, a "decremental rate of increase." I simply recalled this fact, and suggested a revival of the idea, if only for the purpose indicated in the course of my remarks. Why an attempt should now be made to discredit it, I am at a loss to understand.

Your assumption that I attempted to trace, by recollection, the origin of the phrase, is quite a mistaken one. Mr. Livesey's speech was before me when I wrote; and it would have been easy for me to have pointed out whence he derived the expression. But it certainly never occurred to me that anybody could care a straw as to who, of all the sons of Adam, first used it, or whose forensic eloquence happens to have been employed against it. Nor, with all deference to you, can I yet bring myself to believe that these are matters of absorbing interest. The phrase itself lives, and will continue to live, because, as Mr. Livesey says, it is "a proper expression." My sole object was to reproduce, with sufficient exactness, Mr. Livesey's idea and words. In this, I claim to have succeeded; but, if otherwise, it is for Mr. Livesey to put me right.

Birmingham, May 26, 1892. CHAS. HUNT.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Bills last week:—

Bills read the first time: Gas Provisional Orders Bill; Middlesbrough Corporation Bill.

Bills read a second time and committed: Bournemouth Improvement Bill; Gas and Water Orders Confirmation Bills.

Bills reported: Blackburn Corporation Bill; Brynmawr and Abertillery Gas and Water Bill; East Grinstead Gas and Water Bill; Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3); Rhyl District Water Bill; Rhyl Improvement Bill; Water Companies (Regulation of Powers) Bill.

Bills read the third time and passed: Electric Lighting Provisional Orders Bills (Nos. 1, 2, and 3); Mold Water Bill; Newport Corporation Bill; Southend Gas Bill.

Petition presented against the Water Orders Confirmation Bill [Sevenoaks Water Order], from the Sevenoaks Rural Sanitary Authority and the Sevenoaks Local Board.

HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bill read the first time: Newport Corporation Bill.

Bills read a second time and committed: Ipswich Corporation Bill; Pontypridd Water Bill; Rhymney Valley Gas and Water Bill.

Bills reported: Birmingham Corporation Water Bill; Ipswich Corporation Bill; London Water (No. 1) Bill.

Bills read the third time and passed: Gas Provisional Orders Bill; Middlesbrough Corporation Bill; Tredegar Local Board Water Bill.

Petition presented against alterations in the Pontypridd Water Bill, from the Pontypridd Local Board.

Petitions withdrawn: Guardians of Saddleworth and the West Riding County Council, against the Ashton-under-Lyne, Stalybridge, and Dukinfield District Water Bill; Magistrates and Police Commissioners of Partick, against the Glasgow Corporation Water Bill; Monmouth County Council, against the Swansea Corporation Water Bill.

HOUSE OF COMMONS COMMITTEES.

Monday, May 23.

(*Before Sir* J. PEASE, *Chairman; Lord* F. HERVEY, *Mr.* M'ARTHUR, *and Mr.* V. CAVENDISH.)

LONDON WATER (No 1) BILL.

This Bill—which is promoted jointly by the London County Council and the Corporation, to provide for the appointment of a Committee with power to inquire into the existing supply of water in the Metropolitan area, and to enter into negotiations for the acquisition or lease of water undertakings, and to supply water from any works acquired, leased, or constructed, and also to empower the Council to promote Bills in Parliament in relation to water supply—came before the above-named Select Committee to-day.

Mr. LITTLER, Q.C., Mr. MOULTON, Q.C., Mr. RUSSELL GRIFFITHS, and Mr. FREEMAN appeared for the promoters. The petitioners against the Bill were: The New River and other London Water Companies, for whom Mr. POPE, Q.C., Mr. BIDDER, Q.C., Mr. PEMBER, Q.C., and Mr. CLAUD BAGGALLAY appeared; the County Council of Middlesex and the Conservators of the River Thames (Counsel reserved) the Kent Water Company, for whom Mr. LEWIS COWARD

appeared; the Southwark and Vauxhall, East London, and Grand Junction Water Companies (Counsel reserved); the West Kent Main Sewerage Board (no appearance); the Corporation of West Ham, for whom Mr. CLIFFORD appeared; the Provincial Water Companies' Association (no appearance); the Proprietors of the Lambeth Water-Works (Counsel reserved); the Corporation of Croydon (Counsel reserved); the Hertfordshire County Council, for whom Lord R. CECIL appeared; and the East Ham Local Board (Counsel reserved).

Mr. LITTLER, in opening the case for the promoters, referred to the Bill which last session came before the Select Committee presided over by Sir Matthew White Ridley, and stated that the present was an entirely different measure. It did not affect the interests of the outside district; being limited to the area of supply of the eight London Water Companies. The result, it would be remembered, of the deliberations of the Committee of last year was embodied in a report which stated that the Committee had proceeded on the assumption that, in the opinion of Parliament, it was desirable to establish a single public representative Water Authority for the Metropolis. They considered it to be most desirable that the problem of the water supply of London should be carefully and deliberately examined by the County Council. After the publication of this report, a great deal of discussion and negotiation took place on the subject, which eventually resulted in the appointment of the Royal Commission now sitting. The Corporation of London and the County Council then deliberated together, and came to the conclusion that at the same time that they were pressing on the Government the appointment of a Royal Commission for the purpose of inquiring into the quantity and quality of the existing water supply, they should promote the present Bill, which had for its chief object the nomination of a Joint Water Committee. The duties of the Committee would be to make inquiries as to the existing supply of water within the Metropolitan water area, and the charges made for it, and to enter into negotiations with any public authority or water company for the purchase or lease of any of their undertakings, and to enforce regulations from time to time for prescribing the strength, character, weight, and materials of fittings and appliances to be used for preventing waste. It was proposed that the Committee should consist of 48 members, one-eighth of whom should be appointed by the Corporation, and the remainder by the County Council. The Bill now differed considerably from what it was originally. They had the authority of Mr. Ritchie for saying that it had taken its present shape very largely at the suggestion, and certainly with the approval, of the Local Government Board. Clause 3 of the Bill, which defined the objects for which the County Council should have power to promote Bills in Parliament, had been very much criticized, and was opposed by a large number of people on different grounds. Corporations, local authorities, and water companies had all professed themselves dissatisfied with it; and, as a result, the clause was now struck out and a new one inserted. The new clause was to the effect that the London County Council should have power from time to time to pay the costs and expenses of promoting Bills in Parliament relating to the supply of water in the Administrative County of London and the neighbouring counties, or to any company having powers as to such supply, or to any undertakings of any such company. At present, there was an immense difficulty in entering into negotiation or bargain with water companies with regard to their undertakings; and it could only be removed by the appointment of some responsible body whose negotiations would have weight. One of the recommendations of the Committee of last year was that there should be careful consideration as to how the rights and powers of inhabitants beyond the Metropolitan area should be protected; and some arrangement might possibly be made in future for selling water in bulk to the outside authorities.

Lord HERVEY: Do you consider that the new clause which you have inserted omits any of the provisions which were specifically contained in the old one?

Mr. POPE: On the contrary, it rather extends them, as general powers frequently do.

Mr. LITTLER: It does not prevent powers being applied for, by a Bill in Parliament, to acquire water-works, or to take them on lease. There is not the slightest doubt that the meaning of the new clause is to leave it entirely open.

Lord HERVEY: In fact, it is quite as extensive as your old clause.

Mr. LITTLER said he thought it was; and what the promoters desired was that they should have the power of promoting such Bills as might be necessary. As to the petition of the New River and other Water Companies against the Bill, as a matter of fact the Companies would be the gainers if the proposal were carried out to establish a single representative Board for the Metropolis; and either the Corporation or the County Council must be this authority. Their expenditure under the present Bill was limited to £5000, to be used for inquiries, and so forth; they had expressly given to them the power to spend money on future Bills. He urged that this measure was absolutely necessary in order to enable them, when the report of the Royal Commission was issued, to act upon it.

Mr. POPE: On behalf of the associated Water Companies, I would desire the Committee to give us some considered intimation of the course this investigation ought to take. I do not approve of raising preliminary objections to an inquiry of this kind; but the Bill is put before the Committee as an attempt to realize by legislation the decision of the Committee of last year. I can only say, for the associated Water Companies, that, unless we receive some intimation from the Committee as to the course the inquiry should take, I cannot see any alternative to its being as long and as tedious as last year.

The CHAIRMAN: I think we had better allow the promoters to proceed with their case in the usual way.

Mr. *J. Hutton*, Vice-Chairman of the London County Council and Chairman of the Water Committee of the Council, was then called, and, in answer to Mr. MOULTON, said he had read the Bill before the Committee, and considered that the powers by it were, in effect, the same as those already possessed by other corporate bodies. It was desirable that London should have the same power of expressing its wishes with regard to its water supply as other municipal bodies had, subject, of course, to the Borough Funds Act, as the Bill did not attempt to settle the proposed form of legislation with regard to the actual transfer of any of the water supply to the Council. In his opinion, the Bill carried out the recommendation of the Select Committee of last year. With regard to the money question, it did not in any way touch anything but the power of using the money for making inquiries promoting Bills.

Mr. BIDDER: Of what nature are the further inquiries to be on which you want to spend this £5000?

Witness: They will cover a very wide field. To put it shortly, the question is the quality and quantity of the water, and its capability of supplying London (say) 50 years hence.

Am I rightly informed that you have received the reports of engineers on these questions, which are thoroughly exhaustive and satisfactory?—Satisfactory, but not exhaustive.

What else have you spent money upon besides engineers' reports?—On the necessary analyses of the water.

Mr. COWARD: Have you any special knowledge of water questions?

Witness: None, except what I know through my connection with the Water Committee of the Council.

I should like to ask you why you have brought the Kent Water Company here?—I do not see why you should be here.

Mr. MOULTON: Are there any special references to the Kent Water Company's works in the Bill?

Witness: None whatever.

The CHAIRMAN: Your fourth clause says the Water Committee are to have power to make inquiries as to the "existing supply of water within the Metropolitan water area, and the charges made for the same, and as to the possible sources of supply." Is not the main part of that now delegated to the Royal Commission?

Witness: Yes, no doubt; as far as regards quality and quantity, that would be so.

You have full power over the Metropolitan streets at present, have you not—such as the power to open the streets to lay pipes?—No; that is in the hands of the local authorities—the Vestries.

Have you made up your minds as to whether you will constitute yourselves the Water Authority?—It is rather difficult to answer that question. No doubt the action of the Council would be largely governed by the result of the inquiry before the Royal Commission. If the Bill were passed, the procedure would be, after friendly negotiations had been entered into with any one of these Water Companies, that a recommendation on the subject would be made to the County Council. If the Council adopted it, a Bill would be prepared for the following session; and if both parties agreed, the Committee would approve the terms of purchase.

Do you agree with the recommendation of Sir Matthew White Ridley's Committee, that, if you were constituted the Water Authority, you should be required to purchase the undertakings of the eight Companies by arbitration, failing agreement?—We say it would eventually come to that. We submit that an arbitrator would be guided very largely by the Stock Exchange quotation of the stocks of a water company. An arbitrator might not take such considerations into account as the sufficiency of the service within a given area for the future supply of London; and, consequently, if expensive works had been undertaken by a company, and they had been paying large dividends, it might happen that, although their stock had a high quotation, they might really be on the verge of bankruptcy.

In fact, you have no confidence in any arbitration but your own?—I should be sorry to say that, exactly; but we think an outside arbitrator could not always be trusted.

Mr. *H. L. Cripps*, Parliamentary Agent to the promoters, was then called. In answer to Mr. MOULTON, he said that London could not at present use public funds to promote any Bills in Parliament relating to the supply of water. The previous Bill was one which represented not only London but the whole area around. The general object of the present Bill was to give the County Council a municipal authority in regard to water. There was a peculiarity in the position of London, by reason of the concurrent jurisdiction of the Corporation and the County Council; and it was desired to put London as nearly as possible in the same position as every other municipal county.

Tuesday, May 24.

On the resumption of the proceedings this morning,

Mr. *Cripps* was cross-examined by Mr. BIDDER on behalf of the Water Companies. He said that the power to spend £5000 on inquiries had been withdrawn from the General Powers Bill of the Council, and inserted in the present Bill in accordance with the views of Mr. Ritchie and Sir John Lubbock.

Mr. BIDDER: Taking the range of the whole general subject of the water question, on what matter can the London County Council possibly want to spend money in inquiries which are not covered by the Royal Commission?

Witness: One very important matter, for instance, is the legal power and position of the various Companies. That is a very doubtful thing, which must, of necessity, be very carefully investigated before the County Council can come to any satisfactory conclusion.

The CHAIRMAN: As I read the clause, the money is not asked for the purpose of inquiry into title; but three things are named—viz., the existing supply of water, the charges, and the possible sources of supply.

Witness: The reference to the Royal Commission does not deal with the question of what possible sources of supply there may be outside the watersheds of the Thames and Lea Valleys. It is only a question as between the watersheds of the Thames Valley and the Lea Valley and the rights of those populations on the one hand and the demands of London on the other. The Royal Commission might possibly report that more water was necessary, and that it could not be obtained in those areas; but there was nothing which would enable them to deal with any question of other sources of supply.

The CHAIRMAN pointed out that the clause in the Bill did not go outside the question of the Metropolitan water area.

In re-examination by Mr. MOULTON, witness said that the money was also wanted for carrying on the proceedings before the Royal Commission, and properly placing the case of the County Council before that body.

Mr. *G. Rose-Innes*, Chairman of the County Purposes Committee of the Corporation, and ex-Chairman of the Commissioners of Sewers, examined by Mr. RUSSELL GRIFFITHS, said the Corporation had from time to time taken great interest in the legislation affecting the gas and water supply of the Metropolis, and had spent on the matter large sums of money, by which they had greatly benefited the consumers of both commodities.

Mr. RUSSELL GRIFFITHS: I will take you shortly to the gas first.

The CHAIRMAN: Do we need to go into the question of gas?

Mr. RUSSELL GRIFFITHS: Only so far as it is analagous. The petition of the Water Companies objects to the Statutory Committee; and I am going to show that there is a precedent for it in the joint action of the Metropolitan Board of Works and the City before the County Council came into existence.

The CHAIRMAN: It seems an obviously good arrangement that it should be so.

Witness: In 1868, when the Chartered Gas Company proposed to amalgamate with certain other Gas Companies, the Corporation introduced a competing Bill, and the end of it was that in 1875, instead of purchase, regulation was substituted, with the consent of Parliament and of all parties. In November, 1875, the Board of Trade submitted the scheme of the Chartered Company to the Corporation and the Metropolitan Board of Works, as representing the gas consumers of the Metropolis; and from that time the legislation of the Gas Companies was conducted in accordance with the joint views of the Metropolitan Board and of the Corporation, with very small differences in detail from time to time. In the matter of water supply, in 1886, when the East London, the Lambeth, and the Southwark and Vauxhall Water Companies introduced Bills, the City of London succeeded in having a provision inserted in those Bills for a sinking fund by which the Chamberlain of the City was made Treasurer of the fund; and Parliament agreed to it. That fund was also allowed in 1888 in the Kent Water Company's Bill; and again last year, in the Southwark and Vauxhall Company's subsequent Bill. I was Chairman of the Committee of the Corporation which investigated the water question in 1890 and 1891; and the decision of that body was that it was most necessary that legislation should take place upon the subject before the next quinquennial assessment.

Mr. *W. H. Dickinson*, Deputy-Chairman of the London County Council, gave evidence as to the arrangements come to between the Corporation and the Council as to the promotion of the Joint Bill.

This closed the promoters' case.

The CHAIRMAN said that, before Mr. Pope began his address on behalf of the Water Companies, the Committee desired to intimate that they were of opinion that, in any event, those portions of the Bill which constituted a new Water Authority, with powers of inquiry and negotiation, should not be proceeded with. They understood from Mr. Bidder that there was no objection to those parts of the Bill which allowed applications to be made to Parliament, and gave the cost of such applications, by the London County Council, and which authorized them to spend money on inquiries. If there was to be further opposition to the Bill after this intimation, the opposition must address itself to those points only. If, after this intimation of the view of the Committee, the promoters desired to go on with the Bill (a measure of a more limited character), of course the Committee would give them every attention; but if they considered their Bill to be too limited, and thought they could get powers in other shapes and ways, of course they would act accordingly.

Mr. MOULTON said he felt fully the importance of this announcement; and before proceeding further, he would like to consult with his clients.

The CHAIRMAN said that at present the Committee did not see any objection to an inquiry, and would be prepared to give the Council ample powers and funds for the purpose; but they were not prepared to constitute a new Water Authority, with power of investigation of any kind.

Mr. POPE, on the part of the associated Water Companies, said he should not appear in opposition to the Bill if it were confined to clause 3, and to the paragraph at the close of clause 4 which gave the London County Council the sum of £5000.

Mr. RUSSELL GRIFFITHS, on behalf of the Corporation, asked if it was the Committee's wish to exclude the City from being put into any part of the Bill.

The CHAIRMAN: We do not see any motive for putting in the Corporation. They have always acted with great ability and foresight on this question; and they have plenty of funds with which to do it. They do not ask for powers to apply to Parliament, and they do not ask for money.

Mr. RUSSELL GRIFFITHS: But we do want to be included in a Statutory Committee.

The CHAIRMAN: We do not want a Statutory Committee. I do not like to do drafting for those who ought to do it for me, but the idea that my colleagues and myself have is that the Bill should be confined practically to clause 3 in the first place. "The London County Council shall have power from time to time to pay the costs and expenses of promoting Bills in Parliament relating to the supply of water in the Administrative County of London, and within the limits of supply of the Metropolitan Water Companies." Then you go on to the first part of clause 4; and instead of saying, "the Water Committee," you put in: "The London County Council shall have power to make inquiries as to the existing supply of water within the Metropolitan water area, and the charges made for the same, and as to the possible sources of supply." You would end there; and then you would go on: "The Council may from time to time pay the costs and expenses of such inquiries"—I think it ought to be "by Royal Commission or otherwise," because you rather laid emphasis on what you are going to do before the Royal Commission—"to an extent not exceeding £5000." If you like to add to that amount, we think that £5000 is rather a short sum for any such inquiry as the London County Council wish to undertake. Then I think we should be also inclined to pass a clause such as clause 11, giving you power to charge the costs of this Bill.

Mr. RUSSELL GRIFFITHS joined with Mr. Moulton in asking that the proceedings should be adjourned, to give time for consideration.

The Committee then adjourned till the next day.

Wednesday, May 25.

At the opening of the proceedings this morning,

Mr. LITTLER, on behalf of the County Council, stated that they had very carefully considered the Committee's decision of the previous day, and were prepared to proceed with the Bill.

The CHAIRMAN: Mr. Bidder opposes clause 3, does he not?

Mr. LITTLER: We accept the proposal of the Committee as regards the position of other people.

Mr. BIDDER: Are you going to alter the clauses at all?

Mr. LITTLER: They shall be exactly in uniformity with the decision of the Committee.

Mr. BIDDER said the London County Council had asked that they should have power to promote Bills in Parliament, seeing that they were under a disadvantage in not being able to do so in the same way as municipal authorities in the provinces, under the Borough Funds Act. He ventured to point out that it did not seem to cause them very much difficulty, as they were promoting the present Bill. He thought that any legislation on the subject should follow the Borough Funds Act—that there should be a general clause authorizing them to promote Bills under proper conditions; and to such a clause the Water Companies would offer no opposition. He objected to clause 3 in its present form.

The CHAIRMAN: I think there is a little irregularity. Mr. Bidder must make up his mind whether he opposes further on the preamble before going into clauses. It is open to him, if he thinks it worth while, to go on with his opposition to the preamble.

Mr. BIDDER said the Companies thought that, if the County Council made up their minds to become the responsible Water Authority, there would be no difficulty about the Bills. It was not the power of promoting Bills in Parliament, which anyone could do, that the Council sought, but the power of charging on the rates the cost of those Bills. They were, he thought, trying to get some kind of left-handed recognition from Parliament that they had to deal with the water question before they had made up their minds to become the Water Authority.

Mr. LEWIS COWARD, on behalf of the Kent Water Company, concurred in what Mr. Bidder had said.

The Committee then passed the preamble, and entered upon the consideration of the clauses of the Bill.

It was finally settled that clause 3 should read thus: "The London County Council shall have the power from time to time to pay the costs and expenses of promoting Bills in Parliament relating to the supply of water in the Administrative County of London, and within the limits of supply of the Metropolitan Water Companies; the Metropolitan Water Companies being and including the several Companies mentioned in the schedule of this Act." This restored the schedule which had been struck out. The Committee decided that £10,000 instead of £5000 should be granted to the County Council by the Bill for the cost and expenses of inquiries made by the Council as to the existing supply of water within the Metropolitan area. A definition of this area was added to clause 4, to the effect that it should mean the whole of the area within which any of the Metropolitan Water Companies defined in the Bill had powers to supply.

The Bill was then ordered to be reported to the House.

Monday, May 2.

(*Before Mr.* CAMPBELL-BANNERMAN, *Chairman; Sir* W. HOULDSWORTH, *Sir* H. STAFFORD NORTHCOTE, *Mr.* R. K. CAUSTON, *Mr.* S. GEDGE, *Mr.* P. STANHOPE, *Mr.* POWELL WILLIAMS, *Mr.* W. JAMES, *and Mr.* E. H. LLEWELLYN.)

BIRMINGHAM CORPORATION WATER BILL.

To-day the proceedings on this Bill were resumed; the opposition from Hereford being the principal matter dealt with.

Mr. *J. W. Grover*, examined by Mr. LAWRENCE, said the present water supply of Hereford was entirely dependent on the River Wye, of which river the promoters proposed to take two tributaries. In fact, they desired to appropriate between one-sixth and one-seventh of the watershed serving the city, and from which the purest water was obtained. The taking away of this water would most certainly have a very deleterious effect upon that water which constituted the supply of the city of Hereford. It would have the effect of reducing the standard of purity in the river. The remaining water left to be dealt with by the subsidence-tanks and filtering-beds would be less pure than it was now. The compensation water which the promoters proposed to give afforded adequate redress to Hereford for the damage imposed upon it by taking this water away so far as quantity was concerned; but not as to quality. The 27 million gallons would do little good in purifying the water at Hereford during an appreciable part of the year. The only time in which he could fairly say the compensation water would have been beneficial was in 1887. In that year the rainfall was 44·16 inches against 69·5 inches last year; but that was only for a short time. He had taken 21 years, and had found that it would only have been beneficial in the one he had named.

Mr. LAWRENCE: Is it your suggestion that Hereford should be empowered to lay a main to that of the promoters at Ludlow for the purpose of tapping it, and that the city should be entitled to take a million gallons of water per day free of charge?

Witness: As compensation, yes. That proposal contemplates the whole of the works necessary to tap their main being provided at the expense of the city. I ask virtually for running powers through their pipes for a million gallons a day. The estimated cost of making the necessary works is £30,000. But then there would be the sinking fund and some extra expenses besides, so that the total would be a good deal more than £30,000. The promoters asked us to pay something for the water, and we absolutely declined.

In cross-examination by Mr. BALFOUR BROWNE, witness said the Hereford water could not be made sufficient in quantity and quality for the supply of the city without going to very serious expense, as in neither storeage nor filtration were the works sufficient. If £20,000 or £30,000 were spent, they would be much improved.

Mr. *J. Parker*, examined by Mr. LAWRENCE, said he had been Water Engineer at Hereford for ten years. He had frequently visited the

district proposed to be acquired by the promoters; and he was convinced that an injury would be done to the city unless there was ample compensation. He considered that taking away one-sixth of the pure water would have an injurious result, as it would have exactly the same effect as polluting the river *pro tanto*. If they were left alone, there would be an ample supply of pure water at Hereford for many years.

In cross-examination by Mr. FITZGERALD, witness said the abstraction of the water proposed to be appropriated would have a serious effect on that remaining, because the cleanest would be taken and the dirtiest left. The impurity of the water left would certainly be appreciable. The cost of the Hereford filtration system was about £150 a year.

In answer to the CHAIRMAN, witness said that with care they could go on for another ten years without further expenditure, and then the increase in the population and the necessity for new machinery would entail fresh expenditure.

This concluded the evidence for Hereford.

Mr. FREEMAN then addressed the Committee on behalf of the owners of fisheries and properties on the River Wye, and called witnesses in support of his case.

Tuesday, May 3.

On the re-assembling of the Committee this morning,

Mr. PEMBER said he had to trouble the Committee with the case of the Builth Lead Mining Company, Limited, who complained that both their surface and water rights would be greatly limited, and their operations seriously fettered, if the Bill passed. It was not supposed for one moment that the opposition of the Company would be likely to stop the Committee from saying the preamble of the Bill had been proved, and therefore he said nothing on the general merits of the scheme; but he did ask the Committee to see that the property of the Company he represented was adequately protected. They desired to have a proper purchase clause, which should come into effect within a reasonable time—say, twelve months or so—and that the arbitrator, in assessing the compensation, should consider the worth of the property with regard to both its present and its prospective value.

Mr. CRIPPS said his clients considered the owners of the mine were amply protected. It was only, he thought, a question of a clause; and if his learned friend had brought up one, they would have considered it. This, however, could be done now; and the issue might then be narrowed.

The rest of the day was mainly occupied in considering the cases of certain Welsh opponents, who disapproved of the Bill on the ground that it would materially interfere with their existing rights.

Wednesday, May 4.

To-day the proceedings of the Committee were confined to hearing the case of the opponents of the Bill resident in Birmingham.

Mr. GOUGH said he represented 383 property owners in Birmingham, 53 of whom owned 3285 houses of the estimated value of £291,518. His opposition differed entirely from that of any of the other opponents, because their interests were only, for the most part, such as could be compensated either in water or in money; but his objections struck at the very root, principle, and necessity for the Bill. Having epitomized the provisions of the measure, he proceeded to question the necessity for the proposed works. He said he intended to call evidence to prove that the local water-sources of supply were ample, and that the objections to the quality of the water could easily be remedied. He should show that the hardness of the well water, in so far as it required to be corrected, could be softened at a very trifling cost, and that the objection to the spring water was merely a question of additional filtration.

Mr. POWELL WILLIAMS: Shall you suggest any alternative in the hape of a double supply, or anything of that kind?

Mr. GOUGH said he only suggested an alternative in the shape of a double supply when their requirements necessitated it. He had no intention of suggesting a double service immediately; but he should submit that their local supplies, if properly developed, would be ample for at least 50 years to come, without even the dual supply, and that, by adopting the course his clients suggested, the quality of the water would be very greatly improved, as there would be a considerable increase of water from the wells. He denied that there was any urgency for the Bill, and said that, on the top of all the sources of supply which they could develop, they could, by merely utilizing the waters of the Tame for the sanitary purposes for which they were available, increase their supply to 91 million gallons a day; whereas Mr. Mansergh expected to get from the Welsh rivers, after allowing 27 million gallons compensation, only 71 million gallons a day for the supply of Birmingham and all the other places within the 15 miles limit. The cost of Mr. Mansergh's scheme would be practically ten times as great as that of developing their own resources. He should call evidence to show that it was unnecessary to resort to the waters of the Tame, and that for a very long period to come, they had, within a distance of 20 miles of Birmingham, a large area of sandstone rocks, which would yield about 30 million gallons a day. He should be in a position to prove that to bring the Welsh waters to Birmingham would be like carrying coals to Newcastle; for they had in Birmingham what was, at any rate for them, an unlimited supply of water. He objected to the celerity with which the Council voted the scheme, involving an expenditure of nearly £7,000,000 sterling; and he complained that it was never adequately debated. The town's meeting, too, could not be said to represent the feeling of the town. There was no adequate discussion of the scheme; and altogether the meeting was irregular.

The CHAIRMAN said the Committee were satisfied that everything was regularly done; and if there was any irregularity, it was not a matter for the Committee. The opponents of the Bill could have gone elsewhere to quash the proceedings.

The TOWN CLERK said that every formality was complied with.

Mr. GOUGH (continuing his argument) said there was no evidence to show that the Welsh water had ever been tested for lead, copper, zinc, arsenic, or peat; and he would call witnesses to prove that there were all those objectionable characteristics in the water, and that the water would have to be "doctored" before it was free from those objectionable features. The double-service system had been received with a good deal of contempt; but it had long ago been introduced into several towns of importance, such as Southampton, Hartlepool, Newcastle-on Tyne, Shrewsbury, Stockton-on-Tees, and Middlesbrough. Besides these places, it had existed in Paris for 40 years. *Primâ facie*, it seemed rather a sin and a shame to use potable water for sanitary purposes, especially when, according to the promoters, the supply was running short; and if they adopted the secondary system he suggested, they would save the enormous expense of the scheme before the Committee. In conclusion, he said that a great change had come over public opinion in Birmingham on the subject of the Bill. It was perfectly true that, at the time the town's meeting was held, a great amount of apathy existed; but since the application to Parliament had been made, there had been a change. The petitioners against the Bill altogether numbered 10,000 or 15,000. Taking all the facts into consideration, therefore, he asked the Committee to say that the claim for urgency had not been proved.

Thursday, May 5.

At the commencement of the proceedings to-day,

Mr. WOOD announced that the Corporation had arranged terms with the tenants and occupiers of the watershed. They had agreed not to disturb them, and had promised to grant them leases for 21 years at the same rent and on the same conditions as they had hitherto enjoyed. The tenants, too, would be allowed to remain in occupation of the land not actually required for reservoir purposes.

Mr. CRIPPS, on behalf of the promoters, said there would be a clause in the leases that nothing should be done to affect the purity of the water.

The CHAIRMAN remarked that it was very satisfactory that the matter had been settled on such amicable terms. It was only what he expected from the way in which the Corporation had negotiated other things in which local interests were concerned.

Witnesses from Wales were then called by the Committee to give evidence with respect to the rights of the people in the neighbourhood of the watershed which might be affected by the Bill. It was found, however, that their objections could mostly be met by clauses.

The evidence of the Birmingham dissentients was next commenced; but we give only that of the more important witnesses.

Professor *E. Hull* said that for many years he had made the question of underground water a special study, and had had considerable professional experience in advising public bodies as regarded this source of supply. He had an intimate acquaintance with the geological structure of the district around Birmingham, having been engaged for several years, while on the Government geological survey of Great Britain, in surveying the districts adjoining the coal-fields of South Staffordshire, consisting of the new red sandstone and permian formations, which were the greatest water-bearing strata of the central and northern counties of England; and, from his knowledge of their extent and water-bearing capabilities, he was prepared to maintain that, within a few miles of Birmingham, there were abundant supplies of excellent underground water which could be utilized, and were capable of being made use of, in addition to those already in existence. Witness proceeded to describe the district north of Birmingham; saying that the tract between Sutton Coldfield and the boundary of the South Staffordshire coal-field on the west, and ranging northwards for several miles, would give an area of 20 to 25 square miles of new red sandstone. The southern limit of the tract would extend to within about a mile of the King's Vale pumping-station. The quantity of water from this area might be taken at from 5 to 6 million gallons per day. The district of Cannock Chase between Cannock and Stafford was formed of new red conglomerate, and was capable of giving large supplies of excellent water. The area was about 35 square miles; and there ought to be a supply of from 10 to 12 million gallons of water available. East of Birmingham, the Over Whitacre district had an area of about 30 square miles; and the tract was formed of permian marls, sandstone, and conglomerates, which were to a large extent water-bearing, and supplied the towns of Coventry and Tamworth with water. At least two pumping-stations, each capable of supplying from 2 to 3 million gallons of water per day, might be established in carefully-selected sites. South and west of Birmingham was a large tract lying between the valley of the Severn and the western and southern border of the coal-field, which consisted of red sandstone and permian strata, and might be regarded as one of the most important water-bearing districts of central England. The area he estimated at above 100 square miles. The strata were of great thickness, highly absorbent, and generally freely exposed to the rainfall, which might be taken at from 28 to 30 inches per annum. Wolverhampton and Stourbridge drew their supplies from this area; but, making large allowances for their present and future requirements, there was a very great margin, which might be made available for Birmingham. Taking the absorption at one-third of the rainfall, or 10 inches per annum, this gave 400,000 gallons of underground water per square mile per day. So that, with an area of 100 square miles, the total quantity of underground water in the area referred to would amount to 40 million gallons daily, of which Wolverhampton, Stourbridge, and other towns might take in the distant future one-half; leaving 20 million gallons available. From all these districts they might, therefore, consider there was still an available supply of 39 to 44 millions. He agreed with Professor Lapworth that Birmingham was admirably suited as regarded its water supply; but he disagreed with him that the city was coming to the end of its resources. It was a remarkable fact that the pure water from the mountainous districts acted very detrimentally on the lead pipes. The water from new red sandstone did not corrode the lead pipes so much. Birmingham was one of the few towns which were exempt from the visitation of cholera when it raged in the country about 50 years ago.

The Committee adjourned until the following day.

Elland-cum-Greetland Gas Company.—This Company are offering for sale by tender 500 new preference shares of £10 each, bearing 4½ per cent. interest per annum. The maximum dividends have been paid on the ordinary shares, now amounting to 12 per cent.; and with gas at its present price, the Company are authorized to pay 14 per cent. The new capital is required to extend the works.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Saturday, May 21.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* FRY *and* LOPES.)

The London County Council, Appellants; The Churchwardens and Overseers of West Ham and the Assessment Committee of the West Ham Union, Respondents.

This case raised the question as to the rateability of the Abbey Mills pumping-station, and the land, premises, house, lodge, and cottages, connected therewith, and also the outfall mains of the sewers in West Ham parish. The pumping-station, land, and premises are assessed at £6227 gross and £4982 net rateable value, and the outfall drains of the sewers at £13,781 gross and £11,026 net; and the poor-rate, the subject of the appeal, was made on May 1, 1891. The pumping-station had for many years been rated at £1875 gross and £1500 net; and in the case of the *Metropolitan Board of Works v. West Ham Parish*, it was stated that the question was what a tenant would give for the station if it was not used for the main drainage, but disconnected from it, and applied to any useful purposes for which it might be made available. It was understood that the assessment had been raised in consequence of the decision of the Court of Appeal in the case of *The Mayor and Corporation of Burton-on-Trent v. the Assessment Committee of Burton-on-Trent* (the Burton Sewage Farm case); and the result of this decision had been not merely the raising the assessment of the station and works at West Ham and the assessment of outfall sewers in several parishes, but also of the assessment of every other place where the Council have works above ground in connection with their main drainage system. The matter came before the Essex Quarter Sessions in July last, and was shortly noticed in the JOURNAL at the time. (See Vol. LVIII., p. 36.) It was then stated that very important points of law relating to the rating of sewers were involved, which would lead to an appeal to a higher tribunal. The case was taken to a Divisional Court, where the assessment was upheld. From this decision, the County Council appealed.

Mr. HORACE AVORY appeared on behalf of the appellants; Mr. REID, Q.C., and Mr. MONTEFIORE, for the Overseers. Mr. GWYN JAMES represented the Assessment Committee; but he intimated that he did not intend to further argue the case.

The MASTER of the ROLLS, in giving judgment, said the only question on which the Court were called upon to give an opinion was as to whether the sewers were rateable. The rest of the works were given up; and as to these they said nothing. With regard to the sewers, they were vested in the County Council—the creation of an Act of Parliament, and having only statutory authority. The Council had the power to make sewers, and they had a duty to maintain them, and to make rates for their maintenance. But their powers were limited; and they could only make rates to enable them to do their duty and no more. Had they the power to be tenants of sewers? This depended upon the Act of Parliament. They had no authority to take sewers on lease, and pay a rent for them. No such power was given expressly, nor did it arise by implication. It was clear, therefore, that they had no right to take sewers on lease. It was said the case was governed by the Burton case. And it would be so if the Council could be such a tenant of the sewers as the Assessment Act contemplated. But they could not be so; and no persons other than the Council could possibly take the sewers as tenants. The Council could not possibly be taken as the "hypothetical tenant" referred to in the Act, for they could not be tenants of the sewers at all; and, even if they could be so, they would be so subject to restrictions that they could not make anything of them, and would not be the sort of tenant intended in the Act. The appeal, therefore, must be allowed as to the sewers, but not as to the rest of the subjects of assessment.

The LORDS JUSTICES concurred.

The appeal was allowed accordingly.

Wednesday, May 25.

In view of the decision of the Court recorded above, the appellants to-day applied for their costs.

Mr. REID resisted the application, on the ground that the Court had no jurisdiction to allow costs except by statute; and no statute gave jurisdiction in such cases. Therefore, on motions for *certiorari*, there were recognizances to pay costs.

The MASTER of the ROLLS asked, if the Court had no jurisdiction to allow costs, how they could require recognizances.

Mr. REID said it was conferred by statute. The learned Counsel cited precedents in support of his contention.

Mr. AVORY maintained that the Court had power, under the Judicature Act, to grant the costs of the appeal. He cited a case in which, he said, this had been held; and under Order LXV. there was power to give costs in all proceedings in the High Court.

The MASTER of the ROLLS said the order mentioned gave no such power except in cases where it was exercised before the Judicature Act.

Their LORDSHIPS came to the conclusion that they had no power to give the costs of the appeal.

The MASTER of the ROLLS, in giving judgment, said that at common law the Courts had no power to allow costs except by statute; and there was no such statutory power in cases on the Crown side in the Queen's Bench Division. Then, under the Judicature Act, Order LXV. was held to give no such power where the Court had not had jurisdiction before. Doubts on the question had arisen, which were settled by 53 & 54 Vict., cap. 44, and section 4 had the effect of restricting the power to cases in which it was exercised before the Act. Nothing was to alter the practice on the Crown side in the Queen's Bench Division; and so it remained in this respect as before. There was no power, therefore, to give costs in such a case as this.

The LORDS JUSTICES concurred.

The appellants' costs were therefore disallowed

Barnstaple Water Company v. Tucker.

This case, which, as reported in the JOURNAL last week (p. 981), was recently decided by Justices Day and Charles in the Queen's Bench Division, on an *ex parte* argument, came before their Lordships on appeal. The question arose on the construction of the following clause in the plaintiffs' Act: "In all cases in which the Company shall supply water at a pressure above or greater than that afforded by gravitation, either from the now existing reservoir or from any other reservoir supplied otherwise than by pumping from a reservoir or pumping-station on a lower level, the Company may demand and take in respect of such supply, an additional rate not exceeding one-fifth part of the rate authorized by the Act." Defendant was summoned before the local Magistrates for not paying his water-rate, estimated at the higher charge under this enactment; and the question was raised as to whether it applied. The old reservoir was at a lower level than his house, and was fed from a natural stream. The water was pumped from the lower to a new and upper-service reservoir; and he obtained his supply from a branch-pipe opening into the pipe between the two reservoirs. The point to be determined was whether or not the Company were entitled to charge him at the higher rate.

Mr. H. F. DICKENS, Q.C., and Mr. ALDERSON FOOTE, appeared for the defendant; Mr. ASQUITH, Q.C., and Mr. THORNE represented the plaintiffs.

At the conclusion of the arguments,

Their LORDSHIPS came to the conclusion that the case came within the enactment, and that the Company were therefore entitled to charge the defendant at the higher rate.

Judgment was therefore in favour of the Company.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Thursday, May 26.

(*Before Justice* KEKEWICH.)

Gadd v. Mayor, &c., of Manchester—The Gasholder Guiding Patents.

To-day the reserved judgment was delivered in this important case, the proceedings in which were fully reported in the JOURNAL during the hearing (see *ante*, pp. 628, 668, 853).

His LORDSHIP said: As frequently occurs in cases of magnitude and difficulty, and more especially in cases concerned with patent law, there fall for decision several independent issues. Without saying that there are not subordinate questions deserving consideration, I treat three as of prominent importance; and there is no occasion to discuss others, except in connection with one or more of these three. They are: (1) Whether the invention claimed by the plaintiffs was published in this realm by Mr. Terrace prior to the date of their letters patent; (2) whether there is such non-conformity (to use Lord Blackburn's expression in *Bailey v. Robertson*) of the complete specification with the provisional specification as renders the plaintiffs' letters patent invalid; and (3) whether the plaintiffs' invention has been anticipated otherwise than by Mr. Terrace's publication, if publication there were. These are the questions on which the arguments on either side have proceeded. They were not stated by Counsel in precisely the same language, or in the same order; but I shall treat them in the order just mentioned. First, then, as regards the alleged publication by Mr. Terrace. It is admitted on the part of the plaintiffs that there is no substantial difference between the product of their industry and the product of that of Mr. Terrace; and that if there were a publication by Mr. Terrace, it took place before the plaintiffs filed their provisional specification. So that, in that event, nothing remained for the plaintiffs to give to the public—nothing on which letters patent could properly operate. Again, what Mr. Terrace did is beyond dispute; there is no conflict of evidence about it. The facts are contained in a few letters, and in the clear evidence of a few witnesses, the truth of whose testimony is unchallenged. What is the law on the subject? I have been unable to verify the Attorney-General's quotation from Mr. Hindmarch's book; but I accept the proposition advanced on the authority of that book and the decided cases cited in argument, that, in order to establish publication, there must be proved an intention to publish, unless the acts done clearly produced that effect. Intention to publish may, of course, be declared; but where not declared, may nevertheless be concluded, and this even notwithstanding declarations to the contrary from the facts proved—the judge or the jury, as the case may be, being driven to make the reasonable inference from all the circumstances of the case. Intention, apart from the question of publication or non-publication, is necessarily one of fact to be proved and decided like other questions of fact. Overmuch weight must not be given to the number of persons to whom the secret is communicated; but the number of persons is a factor which cannot ever be disregarded, and may, in connection with the other circumstances of the case, be a matter of serious moment. This seems to have been the opinion of Sir George Jessel, expressed in *Plimpton v. Malcolmson* (3 Ch. Div., 531), which is a valuable authority on this and other questions of patent law. He discusses on p. 556 what is sufficient to make an invention part of the common knowledge or of the public stock of information; and he there says: "If a sufficient number know it, or if the communication is such that a sufficient number may be presumed or assumed to know it, that will do." He is not there considering confidential communications; but the statement appears to me to hold good even in such cases. Whatever a man's declared intentions may have been, however credible his statement that he communicated the secret only in confidence, communication of his secret to a large number of persons is inconsistent with secrecy, and must be so treated. This must especially be so if, as regards any one or more of the persons to whom the communication is made, there is no satisfactory reason for it, or the reason is manifestly a desire that the particular person should know what has been, or is proposed to be, done. My own decision in the case of *Blank v. Footman, Pretty, and Co.* (39, Ch. Div., 678), to which I will not further refer, proceeds on this basis. On the other hand, it is clearly laid down in the text-books, and established by a long series of cases, some of which were cited in argument, that

an inventor is entitled to make experiments to test an invention, and for that purpose to employ others—if need be, a large number—to assist in those experiments. Further, he may take others into his confidence, and obtain their advice and opinions respecting the practical or useful character of his invention. It is impossible to fix any number; and, indeed, it is obvious that, in some cases, gross injustice might ensue if communication were not allowed to such a numerous body as would in some other cases be absurdly large. This is well illustrated by the case of the experiments with a machine for paying out cables, cited by the Attorney-General. It must always be a question of fact, to be reasonably considered with reference to all the circumstances, and the reasonable conduct of prudent men. Judged by this standard, Mr. Terrace's acts do not, in my opinion, amount to a publication. That he did not intend publication is not capable of dispute. He conceived himself to have made a discovery which, if really practicable, solved difficulties long present to the minds of those versed in such matters, and in a manner calculated to unite ability and economy in no common measure. The native caution which was attributed to him was undoubtedly increased by reasonable doubt whether this result was in truth achieved; and he wished to submit the merits of his discovery to the advice of some persons competent to express an opinion. He apparently had no definite intention to apply for letters patent; but, on the other hand, I think that his first letter to Mr. Gadd indicates that the possibility of his doing so was present to his mind even before the suggestion came from Mr. Livesey. His anxiety that Messrs. C. and W. Walker should not make his secret known assists this conclusion, with which his communication to those gentlemen is perfectly consistent. His other communications were all of a confidential character, as is particularly seen from his sending with the drawing a copy of Mr. Livesey's letter. He ran some danger of defeating his own intention. No injunctions to secrecy, however honest and however cogent, would have availed him had any of the persons with whom he communicated committed a breach of confidence, and disclosed the secret in such a way as to make the discovery part of the common knowledge; and, in my opinion, if this had in fact been done, it would have been no answer on Mr. Terrace's part to prove that each person to whom the communication was made was, in his turn, pledged to secrecy. There was, however, no such breach of confidence. The drawing was communicated to some persons—namely, Messrs. Duncan and M'Kechnie—who were unknown to Mr. Terrace, and to whom he never authorized or intended it to be shown. But they were aware of Mr. Terrace's intention to avoid publication, for they saw Mr. Livesey's letter; and they cannot be regarded as of themselves constituting such a section of the public that communication to them was equivalent to publication. It was attempted to bring this case within the principle of *Humpherson v. Syer* (4 Reports, Patent Cases, 407). The contrast pointed out by the Attorney-General between the careless conduct of a man who knows that he has secured protection for his discovery, and the caution of one not yet arrived at this stage, is sound; and the reasonable inference to be drawn from the states of mind depending upon their relative positions sufficiently, in my opinion, turns the edge of that case, and converts it into an authority rather for the plaintiffs than for the defendants. Consistently with this, consistently also with all the other authorities cited, and the principles which they illustrate and on which they are based, I hold that Mr. Terrace's acts were not a publication of his discovery, and therefore do not avail against the plaintiffs' letters patent. The second question—whether there is non-conformity of the complete with the provisional specification—opens considerations of an entirely different character. The general law is clear, and the decision must turn on the instruments, construed with the aid of expert evidence, and by the light of what is proved to have been common knowledge. That the rule touching non-conformity still holds good, notwithstanding recent legislation, is settled by the judgment on appeal in *Nuttall v. Hargreaves* (1892, 1 Ch. Div., 23) for every Court short of the House of Lords; and, having regard to *Vickers v. Siddall* (15 Appeal Cases, 496), may haply not be treated as open there. The rule, and the reason for it, depend on considerations of high practical value which have influenced the arguments and conclusions on which they are supported. The bargain made with the patentee on behalf of the public is that, in return for the protection granted, he shall make full disclosure of his invention, in order that, though not capable of exercise during the period of privilege, it may at once be added to the stock of common knowledge, and that during such period all concerned may be distinctly warned what they may safely do, and beyond what line they will be trespassers. The necessity of this warning is enhanced by the reflection that in all departments of industry there are ever urgent needs known to, and appreciated by, students and workers; and that consequently many hands and minds are often independently engaged in combating some difficult problem, with the result that several contemporaneously approach the same solution, all unconscious that others are as far forward as themselves. For their sake, therefore, it is important that the first announcement of discovery (that made by the provisional specification) should be distinct, and that they should know at once what has been discovered and what not—how far they may usefully labour, and what has now been placed beyond their grasp; or, to borrow an expression from a note quoted during the argument, what is the "area of protection." Against this fair demand for information must be set the reasonable claim of a patentee for time to develop his invention. The last steps in the journey of discovery are often rapid—too rapid for minute observation of details, even though hitherto progress has been tedious; and the goal once in sight, there is a natural anxiety, quickened by competition, to announce the fact forthwith, and secure such advantages as pertain to it, without pause or reflection. The Legislature has recognized the haste of the discoverer as reasonable, and yet has imposed conditions for the benefit of others. He is bound to disclose in his provisional specification the nature of his invention; but he is allowed a sufficiently long time for developing and fully describing it. The liberty thus afforded him has been construed with some latitude; and nowhere is it made more ample than in *Woodward v. Sansum* (4 Patent Cases, 166), where, on page 175, Lord Justice Cotton says: "A patentee, putting in a provisional specification showing the nature of his invention, is not bound to describe the way in which that can be carried into effect and operation; but if he does not describe a way of doing it, and, before he files his complete specification, he either finds out improvements in that way, or a different way of carrying into effect that which is described as his invention in the provisional specification, he is bound to give the public the benefit of what he has discovered as regards the mode of carrying the invention, the nature of which must be described in the provisional specification, into effect, even although there may be improvement, and even invention, which was not known to him at the time." The language of Lord Justice Lopes, on page 178, is equally large, and not less apposite, because it treats the patentee's position as regarded from his own rather than from the public point of view. Notwithstanding this ample liberty reserved to the patentee, the protection of others has never been disregarded; and in numerous cases the Courts have insisted on the principle that the complete must be conformable with the provisional specification, in the sense that there must not be anything in the more perfect instrument which cannot be found, at least in embryo, in that of less formal character. I have endeavoured to express, in a few words of my own, the substance of many decisions in which this branch of law has been expounded, and which, whatever language is used, must be my guides and controllers in this respect. There is no need for quotations here from any of them; but it may be mentioned that reference is more especially made to *Bailey v. Robertson* (3 Appeal Cases, 1055), *United Telephone Company v. Harrison* (21 Ch. Div., 720), *Vickers v. Siddall*, and *Nuttall v. Hargreaves*. In order to apply these authorities, and the principle under consideration, to the case in hand, it is first necessary to inquire what the plaintiff's [Mr. Gadd's] invention is—that is, what is the character of his discovery, in what field of industry he was labouring, to what mechanical or other difficulty he was devoting his special attention, and what solution of that difficulty he professes to have found and published. The complete specification should furnish answers to these queries; and, with them in hand, it should be easy to ascertain whether the provisional specification sufficiently describes the nature of the invention. On this the question of non-conformity depends. That the inquiry mentioned is a necessary preliminary to these considerations, is supported by a proposition of law for which there is the highest authority. In *Vickers v. Siddall*, Lord Halsbury says: "It is an essential condition of a good patent that the invention described in the provisional should be the same as that in the complete specification;" and in *Nuttall v. Hargreaves*, Lord Justice Lindley, after referring to *Bailey v. Robertson* (where, in truth, the same proposition is stated), says: "If the invention described in the two specifications is not the same, the patent is bad." No doubt the identity required is identity of the substantial invention, and not identity of details or the means of carrying the invention into effect. There is room for invention, even in this latter process; and that is what I conceive to be referred to in the passage above quoted from *Woodward v. Sansum*, which must not, of course, be read in anywise inconsistent with the broader proposition last stated. The question to be answered might with accuracy be formulated in language adopted from *Woodward v. Sansum* thus: "Does the complete specification do more than state a different mode of carrying into effect the invention the nature of which is described in the provisional specification?" And, again, it is seen, as noticed by Lord Justice Lindley in that very case, that the question turns upon what the invention really was. It is stated by the complete specification to consist in connecting, by means of torsional or tensional gearing, a number of points round the bottom curb of a gasholder, in such manner that, when one point thereof tends to rise or fall, thesame tendency is transmitted through such gearing round the circle to every other point. This statement expressly mentions a tensional in contrast with a torsional method; and inasmuch as the ultimate question to solve, for which the preliminary inquiry is required, is whether the tensional method is fairly within the provisional specification, such statement is unfortunately of little service, except in showing, what is otherwise clear, that the tensional method is deemed essential by the patentee. Turning to the introductory words of either specification (for, in this respect, the two are identical), one finds that they are concerned with improvements relating to the construction of gasholders, having for their object the supporting of the same, in their working position, in such a manner as to enable the external or upper guide-framing hitherto employed for this purpose to be dispensed with, and yet to give the requisite stability. Improvements, in such a context, must mean certain defined improvements—some, that is, mentioned specifically, and with more or less detail, in the instrument in which the passage occurs. The necessity for this conclusion is strengthened by the reflection that Messrs. Gadd and Mason had already invented, and obtained letters patent for, one improvement designed to effect, and successfully effecting, the object in view, as also by the general principle that an idea is not proper subject-matter of letters patent. It seems, therefore, that Messrs. Gadd and Mason claim to have invented certain definite improvements, having and effecting a certain definite object; and that, when once it has been ascertained what those improvements are, one has an answer to the inquiry, "What is the invention?" It was not suggested in argument that the improvements are not described with sufficient fulness and exactness in the complete specification, and the figures appended thereto, or that a competent workman, having the specification and those figures before him, might not easily construct a gasholder with those improvements in any of the varieties of form thereby disclosed. On the other hand, it was not suggested—at least, I do not understand it to have been—either in argument or in evidence, that any workman, however competent, could, merely on the instruction of the provisional specification, apply the tensional method to a gasholder, or, in other words, construct a gasholder with the improvements delineated in those figures by which the tensional method is illustrated. Let me not be understood as saying that it is the office of the provisional specification to give such instructions. It is not. But if he could not do it without the exercise of the inventive faculty, I venture to think that it must be because the nature of the invention is not sufficiently described, and this notwithstanding the language of Lord Justice Cotton in the passage quoted from *Woodward v. Sansum*; because, having regard to the connection in which that language was used, I consider myself justified in holding that he did not intend to mean that a description requiring further invention to perfect the work would be insufficient

Even if there is attributed to the term "gearing," to which I must return presently, the full meaning contended for by the plaintiffs, it is admitted, on their behalf, that this tensional method is not directly indicated by the provisional specification; but they argue that it must be treated as included therein by an application of the doctrine of "mechanical equivalents." As against this it was argued, on behalf of the defendants, that the doctrine is inapplicable to a specification claiming definite means for effecting an object; but that in such case the patentee must be restricted to the means selected and stated. There is somewhat of logical inconsistency in a patentee saying that the essence of his invention is in the defined means, but that he claims to bring within it other like means not defined. But I do not construe the plaintiffs' language as laying them open to this charge; and were it otherwise, I should not be prepared to hold that mechanical equivalents would be excluded. The doctrine is well established, and seems to me agreeable to the principles of patent legislation, and the authorities by which that legislation has been construed. To tell a patentee of a defined means of effecting a particular object that he must mention every possible alternative of every mechanical unit employed, or incur the risk of supersession by someone else who has found an alternative to be superior to the original proposition, would be to impose a burden never contemplated by the Legislature, and make the task of filing a provisional specification in such a case well-nigh impossible. This, however, leaves untouched the question whether the doctrine of mechanical equivalents assists the plaintiffs. That necessitates consideration of the term "gearing." It cannot be denied that the plaintiffs seek to attribute to this term a meaning far in excess of its proper one, if the standard of propriety is to be measured by the authority of the dictionaries or treatises, or even by common use. On the other hand, the language of practical science, no less than that of common life, is constantly changing; and words are made from time to time to convey meanings of a secondary and perhaps inaccurate character, which nevertheless are by degrees sufficiently recognized. It would, I think, be treating the plaintiffs too severely to bind them to the strict original meaning of "gear" and "gearing;" and if their patent can be upheld by the extensive and vague use of words, I think it ought to be done. The evidence convinces me that, though their use of the words is questionable, it cannot be said to be wholly unintelligible to those versed in such subjects. But this by no means removes all difficulties from the plaintiffs' way. They have to establish that their tensional method, for which they employ rope gearing, requires merely the substitution of mechanical equivalents for the instrument employed in the torsional method, in order to make the former an adaptation of the latter, or a reproduction thereof in a different form. The arguments and evidence have not convinced me that this is a sound construction of the provisional specification. That the language is difficult of construction is at once seen, if, in place of the words of reference, those referred to are written out at length; and the minute criticism which it received in the course of the arguments exhibited other difficulties not at first sight apparent. However construed, it raises the question whether ropes and friction or anti-friction pulleys (assuming these to be "gearing") are "mechanical equivalents" for toothed wheels. I take Dr. Hopkinson's evidence to decide this question adversely to the plaintiffs. He is not the only expert witness on that side; and the others, including Mr. Gadd himself, deserve, and have received, full attention. But when a gentleman of Dr. Hopkinson's scientific standing and experience in the witness-box is put forward as the prominent supporter of the plaintiffs' case, one must attribute great weight to any admission which he makes; and even if the other witnesses are pressed for, and do not make, like admissions, their testimony cannot be allowed to countervail his. I do not, however, find the other witnesses contradicting Dr. Hopkinson. It may be none of them made such pointed admissions, or saw so much difficulty in treating the complete as a development of the provisional specification. But it must be borne in mind that it was not the duty of the defendants to press, and that they did not press, these other witnesses with the same severity; and that Mr. Gadd's personal interest depreciates his testimony though I am sure he intended to be thoroughly honest. A word, however, about Mr. Davey. He was called after an interval which afforded an opportunity to the plaintiffs of furbishing the weapons in their armoury, and manufacturing others of some novelty. But he could not cope with the difficulties presented to him; and his answer to a question (No. 2011) confirms Dr. Hopkinson none the less because of its guarded form. There are some other passages which, explaining the witness's views, show what this answer really meant. Coming to this conclusion on the plaintiffs' evidence, there is no occasion for me to criticize that of the defendants. Suffice it to say that Sir Frederick Bramwell was not driven to make an admission capable of contrast with that to which I have referred on this part of the case. The question upon which I have just expressed my opinion is capable of being stated in a somewhat different, and perhaps broader manner. Read the provisional specification, and, having mastered it, consider whether competent skill would discover therein the germ, the outline, the nature of the tensional method described in the complete specification. Or, inversely, read and master the complete specification, and consider whether the tensional method there fully described is indicated in the provisional specification. The latter is, to my mind, the more accurate way of putting the question; but whichever way it may be put, I think the evidence compels a negative answer. Here, again, I conceive Dr. Hopkinson's evidence to be well-nigh conclusive. His expression is that the tensional method is "adumbrated" in the provisional specification. This, so far as I am aware, is the first use of such an expression applied to such a subject. It is capable of several interpretations, some of which would haply be sufficient to save the plaintiffs' patent; but in the mouth of a witness of such learning and skill as Dr. Hopkinson, I construe it to mean that, however broad and deep the shadow may be, there is nothing of substance, and that the shadow did not afford an outline from which the substance could be perfected. In answer to one question, he would say no more than that when a mechanical engineer came to see the arrangement finally indicated, he would see that the words in the provisional specification applied to it; and in answer to another question, he admitted that no one would have produced from the provisional specification any of the later drawings in the complete specification. I think it unnecessary here to refer to the other evidence, except again to say that Mr. Davey is, after full consideration, in accord; nor need I here repeat my comments on it, which are of the same character as those before made. I have not forgotten Mr. Gadd's original sketch, on which it was said he had made marks indicating that he had then discovered, and intended to include in his provisional specification, the tensional method; or his drawings on newspaper margins. It is quite possible that Mr. Gadd had then made the discovery; and I do not for a moment doubt the honesty of his belief that he had made it, though so large and important an addition to his invention is thus rested on a slender basis. He may have sacrificed accuracy to undue haste; and that undue haste may have been occasioned by Mr. Terrace's communication, and fear that this gentleman might beat him in the race. But I take these inquiries to be of no practical value. If, on the true construction of the two instruments, there is such non-conformity as voids the patent, it is no less fatal because a sufficient description was omitted from the provisional specification by a slip; while, on the other hand, if there be no such non-conformity by it, the patent will stand good, albeit Mr. Gadd did not at once see the whole of his invention, and the fortunate words were inserted without full appreciation of their meaning, or even by accident. The third question is whether the plaintiffs' invention has been anticipated by any of the other patents, or by any of the gasholders mentioned in the particulars of objections. This is a question of considerable detail and difficulty; but I shall dispose of it briefly. Having devoted no little time and thought to it, I desired and intended to express my views for the information of the parties, who might possibly wish to have them, notwithstanding my decision on the second question would make them less useful. But this question has necessarily been considered more or less contemporaneously with the others; and I am not ashamed to confess that, having once arrived at a conclusion on the second question, I have found it practically impossible to treat the third as if a decision thereon were essential to my final judgment in the case. Unless so treated, it could be of little value; and therefore I have been compelled to abandon the task, as I have done. I was much impressed by some of the prior specifications, and especially by those of Wild and Standfield. I cannot help thinking that, if either of these gentlemen had been asked to solve the problem which Mr. Gadd had before him, he would have done it without difficulty by reference to his own discovery as described in his specification; and equally I cannot help thinking that, if Mr. Gadd (whose knowledge outside his own study struck me as strangely narrow, having regard to his attainments, and the work on which he was engaged), had made himself acquainted with those specifications, he would at once have seen that they disclosed what he sought. But this does not make an end to the matter. The discoveries of Wild and Standfield produced results; and, notwithstanding those discoveries, no one had before 1887 seen the way to apply the methods there indicated to gasholders. There is much to be said in favour of the view that the application for the first time to a gasholder of mechanical means before applied on paper only to instruments of so different a character as pontoons and such-like structures, is invention within the meaning of patent law as well as it is in common parlance. That view derived considerable support from some of the cases cited by the Attorney-General—for instance, *Harwood v. The Great Northern Railway Company*, *Otto v. Linford*, and perhaps even still more, *Hill v. Evans*. The passages quoted from Lord Westbury's judgment in the latter case state guiding principles in this direction. I should have hesitated much and long on this point; but, as already mentioned, I have left it undetermined. The short result is that the plaintiffs' case fails. There will be judgment for the defendants, with costs to be taxed on the higher scale.

THAMES POLICE COURT.—Thursday, May 26.

(*Before Mr.* DICKINSON.)

The Commercial Company Fined for Gas Containing Sulphuretted Hydrogen.

To-day the Commercial Gas Company were summoned, at the instance of the London County Council, for supplying, on three occasions, gas of lower purity than is required by statute.

Mr. C. A. ROBERTS appeared in support of the summonses; Mr. G. H. YOUNG represented the Company.

Mr. ROBERTS opened the case by stating that the summonses were obtained against the Company for sending out gas containing sulphuretted hydrogen, which was specially prohibited by their Act of Parliament.

Mr. YOUNG admitted the liability of the Company to forfeiture; but said the question of the amount was for the Magistrate to decide. He hoped to lay such facts before him that a penalty of a penny would be considered sufficient. The quantity of sulphuretted hydrogen in this case was almost inappreciable; and the Examiner in his report admitted that he only found a "trace present." The Chief Gas Examiner (Dr. A. W. Williamson, F.R.S.) also admitted that the Company had considerable difficulty in discovering the source of the impurity, which was the result of a leakage in a large valve; and he was satisfied that the trace of sulphuretted hydrogen was caused thereby. The leakage occurred through no fault of the Company. He proposed to call the best evidence that could be obtained in England.

Mr. *H. E. Jones*, M.Inst.C.E., Engineer of the Company, said he could not think of any means by which the accident could have been prevented. The valve in question was the best of its kind, and had been in use for only six years, while a number of others which had been in use for 14 years were sound.

Sir *Frederick Bramwell*, F.R.S., said he had visited the Company's Wapping station, and was acquainted with the mode of purification carried on there. What happened on the occasion in question was that a leakage occurred in the bye-pass valve, through which both pure and impure gas passed. Under ordinary circumstances, the gas was practically pure, and did not affect the quality of the supply. The presence of sulphuretted hydrogen did not arise from any fault on

the part of the Company. They made absolutely pure gas, and then by an accident it became foul.

Mr. DICKINSON said an accident which was extremely difficult to discover had arisen; and he should therefore impose the mitigated penalty of £3 and £1 3s. costs on the first summons, and £1 and 2s. costs on each of the other two summonses.

WEST HAM POLICE COURT.—Wednesday, May 25.

(*Before Mr.* BAGGALLAY.)

Barford v. The West Ham Gas Company.

To-day the West Ham Gas Company were summoned by Harry Barford, a gas stoker, for £8 1s., being the amount of a month's wages claimed by him in lieu of notice. The matter was taken up by the Gas Workers' Union.

Mr. C. E. JONES appeared in support of the summons; Mr. MORTON represented the Company.

Mr. JONES stated that Barford had been working for the Company for eighteen months; and in April last the Manager introduced some new scoops, which were heavier and longer than those which had been in use before, and therefore he could not lift them. He complained to the officials that he could not work with the new scoops; and their reply was, "If you don't do that, you'll do nothing else here." He therefore went away. One of the men had been injured by a new scoop; and another, who had been with the Company two years, refused to work it on the same grounds.

Mr. *W. Thorne*, General Secretary of the Union, said he had an interview with the Manager, on the 23rd of April, and they had a general conversation about the men refusing to work. Mr. Thorman admitted to him that the materials in this instance were thicker and heavier than those previously used; adding that it was not his fault, as he had directed the manufacturers to make them as before. Mr. Thorman sent for Mr. Robinson, the head foreman, and they went together down to the blacksmith's shop and examined some of the old scoops. They afterwards went to the retort-house where this scoop was in use, and plaintiff and others complained of it being larger and heavier. He went again on the following Monday to see them; and Mr. Thorman suggested that the scoop should be cut down. Witness visited the works next day; and, as the scoop had not then been cut, Mr. Thorman, in witness's hearing, ordered it to be done.

Mr. *E. H. Thorman* referred to the discussion between himself and Mr. Thorne, and said the complainant never returned. Had he done so on Monday or Tuesday, he should have set him on. Witness caused much surprise by stating that they would have been compelled to take the man on; but they would have given him a month's notice, as there a scene that it had to be put a stop to.

In cross-examination, witness said he had not heard a word about a man having injured himself by using this scoop. The principal foreman made no complaint to him. He did not cut anything off the shoe end; but off the handle end of the scoop, where there was never any coal. The men, however, said it was difficult to get the handle on again; and he then ordered 3 inches to be cut off the shoe end. He thought the complaint most unreasonable; but he altered the scoop to save any friction with the men. There had been no difference in the length of the scoop for 25 years; but as soon as he found it out he altered it.

His WORSHIP, without any comments, found for the complainant for the amount claimed; but as it transpired that he had been at work five days out of the month, these were deducted, and judgment was given for £6 12s. 3d.

WANDSWORTH POLICE COURT—Wednesday, May 25.

(*Before Mr.* DENMAN.)

Charge of Neglecting to Supply Water.

To-day the Southwark and Vauxhall Water Company were summoned by Mr. H. Dumas, an insurance broker and an underwriter at Lloyd's, residing at 7, The Cedars, Clapham Common, for unlawfully neglecting to furnish to his premises a supply of water.

Mr. H. DUMAS, barrister, appeared to support the summons; Mr. W. P. HORTON represented the Company.

Mr. DUMAS, in opening the case, said his client had had cause to complain on more than one occasion about an insufficient supply of water. Remonstrances were of no avail, and on the 8th and 9th of the present month considerable inconvenience was occasioned by an absence of water.

Complainant's cook testified that there was no water in the house on the days in question; and Mr. Dumas stated that he always paid the water-rates promptly. On the 8th inst. a telegram was sent to the Company stating that there was, as usual, no water in the house. Some hours later, the supply was renewed.

Mr. HORTON explained the reason for the non-supply of water on the occasion in question. On the 8th inst., the Company were engaged in laying filter-beds at the central works at Hampton; and it was therefore necessary to divert the main-pipe. The complainant's house was the highest on Clapham Common; and when the water pressure was diminished, Mr. Dumas was deprived of the proper supply. He claimed exemption under section 42 of the Company's Act, which deals with the temporary cessation of water through unavoidable causes or the carrying out of necessary works. His further point was that at the time of the suspension of the supply, the rate had not been paid.

Mr. DENMAN observed that this was a very narrow point for the Company to take up.

Mr. DUMAS said that for 30 years the rate had been paid promptly; and the Company had no right to raise such a question.

Mr. DENMAN said the rate had not been paid, and the complainant must fail in consequence. He dismissed the summons on this ground alone; observing that he had to carry out the Act of Parliament as he found it.

MISCELLANEOUS NEWS.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Tuesday, May 17.

Lord BALFOUR OF BURLEIGH, *Chairman; Sir* G. B. BRUCE, *Sir* A. GEIKIE, F.R.S., *Professor* DEWAR, F.R.S., *Mr.* G. H. HILL, M.Inst.C.E., *Mr.* J. MANSERGH, M.Inst.C.E., *and Dr.* W. OGLE, *Commissioners.*)

On the resumption of the proceedings to-day, Mr. *Francis* wa recalled for the purpose of giving some further particulars in regard to the wells.

Mr. MANSERGH remarked that the water from the Chadwell Springs was delivered by gravitation; and he wished the witness to draw a line on the plan through all the wells, giving approximately the normal level of saturation—that was, the level to which the water rose after pumping had been stopped for some time.

Witness said he would furnish the statement.

Evidence was then called on behalf of the East London Company.

Mr. *W. B. Bryan*, M.Inst.C.E., examined by the CHAIRMAN, said he had been Engineer to the East London Water Company for ten years. They had two intakes—one at Ponder's End, and the other just below the Ordnance Factory at Enfield. At the former, the water left the navigation, and came along the river to Chingford Mill, where the river took the whole stream. The other intake stream went by Sewardstone, and joined first just above Chingford Mill. The water they took finally left the River Lea at Chingford Mill. It did not go back again into the river when it came down these subsidiary streams. They took out of the river, at their upper intake, whatever was flowing down, and passing their works—the whole of it. It amounted, on an average, to from 32,000,000 to 33,000,000 gallons a day, including also what passed out of the river at Ponder's End. The low-level reservoirs were supplied from the tail of the mill. The water from the lower intake went down to the mill-stream, which was cut off absolutely from the Lea. A large quantity of water went into the Lea beyond what was required for the navigation; in fact, the whole of the flow of the river which was not taken into the Company's reservoirs. The bulk varied with the season. In a very droughty season, the quantity which passed down was not very great, though it was never reduced to nothing. Taking one day with another, last year the average was upwards of 35,000,000 gallons; but in 1890 it was more than 37,000,000 gallons. He believed the New River Company might, if they chose, take half of what the East London Company took beyond the 22,500,000 gallons. But there was an arrangement for taking water when it was in flow; and his Company had constructed large reservoirs for the purpose of taking it when the river was high. The distance from the New River Company's intake to the upper intake of the East London Company, measuring along the course of the river, was, roughly speaking, about 22 miles; but measured in a straight line, it was much less than that.

The CHAIRMAN: It has been stated to us that the Lea Conservancy do not wish to have so large a quantity as is allotted to them by the Acts; and reference has been made to the proceedings before the River Lea Committee in 1886 in proof of this statement. Have you any comments to make upon that?

Witness: The only comment I have to make is that the Lea Conservancy take as much as they require for the navigation—that is, they may do it, though I am not prepared to say they do. I can say, however, that my Company have never objected to their taking the full quantity of water; nor have they ever asked the Lea Conservancy not to take it.

Have any other persons made complaints in that respect?—Not that I am aware of, to my Company. There have been letters sent to the newspapers.

You estimate for the future 30,000,000 gallons a day as the amount it will be safe for your Company to take from the Lea, and the full amount you can draw from the Thames. At present, have you ever drawn your full quantity from the Thames?—Yes, as nearly as possible. We get about 9,800,000 gallons. That is as near as we can reckon it. We have drawn that quantity for a fortnight together. We took as much as 9,750,000 gallons a day for about four weeks in 1885; but not so much since that time. The average quantity we draw from the Thames comes out very much lower than that.

Do you think it safe to estimate for the future that you can take 10,000,000 gallons a day?—Certainly. I do not know for the moment, what the population of the Lea Valley above our intake is, though I have gone into the matter.

Do you think the quality of the water at the point where you get it (your raw material), is improving or getting worse?—Improving, distinctly. As regards our Thames works, we do not take in any water there when the river is in flood. We rely upon our storeage reservoirs in the Lea Valley. We have a subsiding basin holding 5,000,000 gallons; but it is very small.

Asked if he had any remarks to make with regard to pollution of the Lea from traffic, witness said that whatever pollution there might be was very infinitesimal. The bulk of the traffic along the Lea stopped short below the Company's intake. Some of it went higher, but he could not say how much. The gaugings of the river during the last twelve years, which had been tabulated, had been taken in such a manner as practically to vitiate all the original gaugings, from the fact that mistakes had been made by a new lock-keeper appointed on the death of his predecessor. The gaugings were taken at eight different gates; and the lock-keeper mistook between east and west, and read them in the wrong sequence. This was only discovered at the time of the River Lea Commission, when it became evident that something was wrong because the quantity of water coming into the Company's reservoirs did not agree with that which was stored in times of difficulty. The same thing occurred during the intense frost of December, 1889. According to the gaugings, the amount was 13,000,000 gallons a day; but instead of this, the Company were only drawing 3,000,000 gallons. Fresh gaugings were then taken.

The CHAIRMAN: What we want to know is, what was the minimum quantity of water going over the weir for a certain number of days, or weeks, or months in summer—say, for any particular period in 1887.

Witness: August, 1887, was rather a droughty month. The flow was pretty equal from the first day to the last. The average amount was 2465 cubic feet per minute.

We cannot take it in that way; we have been dealing with the matter by the numbers of gallons per day.—In October, 1884, it was 30,000,000 gallons a day; for August, 1887, it was about 22,000,000 gallons flowing over Field's Weir. I could not say how much of this would go to the navigation below, because there is a certain quantity taken for this purpose, which would be prevented from passing over the weir.

Have you any other information to give the Commission with regard to the springs or wells from which water is supplied?—We have two wells in process of construction. No account has been taken of the exact quantity of water pumped from the river into the filtering-beds. It would not be very large—not exceeding 2,000,000 gallons a day. I could give exactly how much we distributed from our reservoirs.

What would really be the most adverse set of circumstances which you consider likely to occur in making your estimate of supply?—I think prolonged frost. Suppose the rivers were to be somewhat dry at the end of the year, and we had a very prolonged frost, as we had in the winter of 1889-90, this would be the time when our resources of water would be lowest. We should then have perhaps more water in the wells, but not so much in the river.

Can you give me figures to show for how long you may not get so much water out of the river, and may have to supplement it by the well and storeage water?—I think the longest period would be from two to three months that we should have to draw from our storeage reservoirs and wells. During that time, I think we could get out of the river from 20,000,000 to 22,000,000 gallons a day; you might put it at 20,000,000 gallons.

Under these circumstances, what amount would be drawn from storeage and from the wells?—We should take 20,000,000 gallons from the Lea, 10,000,000 gallons from the Thames, at least 6,000,000 gallons from our existing wells, and the remainder from storeage. Our total storeage capacity is 910,000,000 gallons. We have more than this, because we have many acres of gravel which are saturated with water; but if you take it at that figure, you will not be far out.

By Mr. MANSERGH: I had no means whatever of stating what quantity we have taken daily from the river. The whole of the water passes through our reservoirs; and we cannot take any direct to our filter-beds without its going through the reservoirs. When the Lea is in flood, we close the intake absolutely for a week together, and sometimes for longer than that. At our Lea Bridge works, we have 25 acres of filter-beds. The maximum area we have out of use at any time for cleaning would be about 3 acres. The length of stroke of the engines varies greatly between night and day. The approximate shortness of stroke would be about 10 per cent. We have a very large amonnt of reserve power. At the pumping-stations, we have engines capable of pumping the maximum quantity required; and a reserve as well. We have sometimes pumped 55,000,000 gallons; but a great portion of it goes to waste. As regards the future, our increase will all be in the Essex district. The average population per house in the London district is 7·62; in our Essex district, it is only 6·1.

Professor DEWAR: In the statement sent in by the Lea Conservancy, there are named several sewage-treated towns above your intake, in addition to the sewage and cesspool towns. Altogether there are 13 sewage-treated towns above your intake and that of the New River Company. Are you acquainted with any of those towns?

Witness: Only with Hertford and Cheshunt. Cheshunt does not now drain into the river. The East London Water Company constructed a separate drain, about 30 or 40 years ago, extending as far as Ponder's End, and now they treat their sewage themselves. By arrangement with the Company, the effluent is discharged some distance below the intake.

Would it be fair to say that the analysis of the East London water would show an increase of 50 per cent. of organic impurity more than that of the New River Company?—I cannot speak with certainty; but I have no doubt that the amount of organic impurity in the East London water is greater than in that of the New River Company, who have a larger amount of well water. I attribute it also to the better position of their intake; but I do not think there is much contamination in the River Lea between their intake and ours.

You do not attribute this increased amount of organic impurity to the 13 sewage-treated towns between their intake and your own?—No; I attribute it, in a great measure, to the addition of the well water, and not to any large addition of animal or vegetable impurity in this water.

By Mr. HILL: My Company have acquired a very large area—some 90 acres—adjoining their existing reservoirs and higher up the valley, for the purpose of supplementing their storeage; and farther up they have excellent sites on which storeage reservoirs can be built. At present the Company are in possession of a very large area for storeage purposes. We do not take in turbid water; and the figures given are quite irrespective of that. At first the flood water is rather thick; but five or six days afterwards, it is in very good condition. This depends upon the amount of rainfall; and if it is continued, we shut down our intakes and draw from our storeage. In no case, in my experience, have we been unable to fill up again with good water two or three days after floods. The levels of the gravel and London clay are very uneven. Some years ago, the Grand Junction Water Company had to go to considerable expense to exclude sewage from the gravel; but this was not a parallel case to that of the East London Company, because a building estate was about to be opened up at that time near the Grand Junction works.

By the CHAIRMAN: A supply of 2,000,000 gallons per day is taken at Hanworth, two miles north of the Thames. This is not included in the 10,000,000 gallons taken from the river. The level of the Hanworth water is 13 feet higher than that of the Thames. When we cease pumping, it is from 4 to 5 feet below the surface of the ground; and when we pump it is 4 or 5 feet more. I do not think there is much danger of pollution from cesspools and from the surrounding population, because we drive tunnels through the London clay, and then take in the water through perforated pipes. These tunnels are 600 or 700 feet from the nearest houses, and are about 40 feet below the surface. They have no reference to the level of the water, and are driven in the clay as a matter of convenience. Over the clay there is a gravel bed. The supply of 2,000,000 gallons of water a day would depend upon the ground not being opened up for building purposes. The water has been analyzed, and the report was satisfactory.

By Professor DEWAR: The 22,000,000 gallons constitute the entire amount available for any Company; the navigation being provided for, and the New River Company having previously extracted their water. The total flow would be that quantity *plus* what is taken by the New River Company—*i.e.*, 44,000,000 gallons a day. The upper reaches of the Lea are so permeable to percolation that the ordinary gaugings are quite useless. I have not therefore estimated the rainfall, but have taken the measurement of the river itself without giving any fractions for the rainfall. However, percolation results can easily be given.

By Mr. HILL: I think the supply at Hanworth is permanent, because there is a bank of clay which holds up an immense mass of water, and the gravel bed extends 70 or 80 square miles. Ever since we have been pumping—that is three or four years—I have had the depth of water in a bore-hole taken every week; and I find that the supply is permanent. It is water on its way to the Thames, at a much higher level; and our pumping has not been shown to have any effect. The pumping is not absolutely continuous. We are simply taking a small portion of a surplus which is ever flowing towards the river.

By Sir A. GEIKIE: There is a large tract of country to the north of Hanworth which is very permeable; and I think the water comes from there. The ground is not built over; it is a very sparse population indeed.

The CHAIRMAN: Can you furnish us with information as to the wells, their depths, bores, and the amount of water taken from them?

Witness: Our most northerly well is at Waltham Abbey. The cylinders are of cast iron, and are taken into the chalk, so as to exclude any surface water between that and the London clay. That shaft is continued 198 feet from the surface. Galleries have been driven from it, and bore-holes from the bottom of the tunnels. The total yield of that well is slightly over 5,000,000 gallons. At Walthamstow we have a well 15 feet in diameter carried down to the chalk. It is only in process of construction at present. Tunnels are being driven; and we are pumping 2,000,000 gallons a day into the canal.

Your statement is that you take from the wells 3,681,000 gallons, of which 1,500,000 gallons come from the Hanworth Springs; so that you can only have 2,000,000 from the other wells. Yet from this one well at Walthamstow you say you pump 2,000,000 gallons a day into the stream?—But that has not been counted. The water is so chalky while the well is in course of construction, that we pump it to waste to get rid of it. From Waltham Abbey we are pumping at present 800,000 gallons a day direct into the district. Last year the Chingford Well was in operation the whole time, and would average about 500,000 gallons a day. At that time we were also pumping at Walthamstow from an old artesian well sunk in 1867 by Mr. Greaves, the Company's Engineer; and we were pumping from that about 400,000 gallons a day. The remainder of the 3,681,000 gallons was the estimated quantity taken from the gravel springs at Hanworth.

So that last year, exclusive of Hanworth, you had only three wells directly serving your district?—Yes: from the existing wells in the Lea Valley we can get 11,000,000 gallons; that is 9,000,000 gallons more than we are now taking.

You propose to take 20,000,000 gallons a day more than you are taking at present?—Yes; so that between the two Companies we propose to draw something like 44,000,000 gallons more a day from the chalk wells than we are drawing now. With regard to depression, complaint was made that we have reduced the water in Hertfordshire, close to Walham Cross Station; but last Saturday (May 14) the water-level was about 15 or 16 feet from the surface, and 100 feet above the chalk. This shows at once that the depression cannot go very far. The Tottenham Local Board have a well from which they draw water by suction-pipes. The result is shown that we have not depleted or decreased their water in that well. In all the cases I have investigated, I have found that we have not lowered the water in anything like the manner stated.

Do you think it is a safe estimate that you can take 44,000,000 gallons of water more than you have been in the habit of taking?—Yes; because, in my opinion, there is an immense body of water running to waste, in a south-easterly direction, into the Thames near Purfleet, Grays, and that neighbourhood. I feel confident that there is a huge volume of water passing steadily in that direction into the Thames; and the quantity we pump from it is simply some of the surplus. Our wells fill up again immediately after we cease to pump. The water comes up the shaft at the rate of 40 feet an hour at Waltham. We cannot reduce the level, with our existing pumps, to nearer than 128 feet from the bottom of the wells.

By Sir. G. B. BRUCE: We obtained power to sink wells by an Act passed in 1866.

By Mr. HILL: The taking of 44,000,000 gallons of water will not affect the surface of the surrounding country as far as my Company are concerned. The level of the water above the London clay remains exactly the same day by day. I cannot see how any amount of abstraction from the London chalk can affect the surface streams or the springs generally. There is no outcrop of the chalk in the East London Company's district.

The CHAIRMAN: Let us have the calculations upon which you have arrived at the average number of gallons of water per head per day supplied for all purposes in 1871, 1881, and 1891; and you can put into that, if you like, the reasoning by which you think some of the calculations may be made fallacious.

Witness: My calculations have been made fallacious simply by following the returns of the Registrar-General. In 1891 the number of supplies was 172,310; and in making my estimate for the future, I had to take into consideration that in the county of London there has lately been a decrease in the number of houses.

You have divided your district into intra and extra Metropolitan. Where is your line of division?—There are 104,000 supplies within the Metropolis; that is to say, within the county of London. The division is according to the area of the County Council.

What is the reason for taking that rather than dividing the number

of gallons by the supplies?—For the reason that the character of the London area supply is so different.

Will not the districts change in the future as they have changed in the past?—The whole character of the district outside London is such that you cannot take 7·6 as the figure. The houses are very small—four-roomed, in general. The calculation for future supply comes to about 33 gallons per head per day.

You have based upon that assumed figure your calculations as to supplying the gross amount of water you think you may be called upon to send out for the next 40 years?—Yes. I think that is not only a safe, but an excessive amount to estimate for our district, because there is now such a wretched state of things in our supply at the East-end of London. For years the whole county of London has had a constant service; and this increases very much indeed the quantity of water supplied per head per day. In that respect our experience and our population differ very much from those of other companies. There is an utter carelessness among the poorer classes in using water; and the alien immigration has caused an immense amount of waste. Their practice is not to use water with soap in the ordinary way for washing clothes, but to leave the taps running over them for perhaps a couple of days. In some places the consumption runs as high as 70 gallons per head per day. The landlords are willing to help us; but they are quite powerless to deal with the tenants. There is very great waste in the dead of the night. To meet the difficulty of defective fittings, during the last three or four years, my Company, instead of serving notices on the people, have repaired the taps themselves, and put leathers on free of cost. There is a most hopeless condition of things in some parts of the East-end of London. That is the reason I have kept my estimate so high as 33 gallons.

By Dr. OGLE: I do not assume by supplies the same thing as the Registrar-General in returning houses; but it does not affect the results, because I take our total population, and divide by our total number of supplies. In my opinion, I have given much too high a figure for future increase. It is most difficult to estimate the future population of the East-end of London. One or two more Dock strikes would leave very little population in Canning Town and the neighbourhood. That is a decreasing population. It is impossible to tell what the East-end of London will become in a few years. Its prosperity has already been checked. Future increase will probably go farther down the river outside our district. With regard to the 14,000,000 gallons, I am assuming that the increase in future cannot possibly be as rapid as in the past. As to the alleged depletion of the River Lea, it is as full now as it ever has been. Then navigation has always been kept fully supplied. If you dig down a couple of feet anywhere in the valley, you come to water. I do not agree with the complaint made by the Lea Conservancy as to the alleged difficulty in keeping the navigation going at and below Old Ford. The tides come up, and leave a deposit of mud; and they have filled up the compensation reservoir which was constructed by my Company a great number of years ago, so that the mud is no longer flushed out.

Sir *F. Bramwell*, examined by the CHAIRMAN, said he had directed his attention to the points which the Commission was appointed to consider. He had been consulted by the East London Water Company for some time past, especially with reference to this question; but had no official connection with it. One important question was the growth of the population. The Company's district comprised two divisions—one within, and the other beyond the Metropolis. The former should be taken as practically filled up, and incapable of extension as regards water supply requirements. The extra-Metropolitan area was capable of more extension. With regard to the supplies of the Company, both external and internal, between 1881 and 1882, the percentage of increase was 3·6; in the next year, it was 3·9; and in 1891, it was 1·7. He had not dealt with the rural population of the Lea Valley; but with regard to the urban population north of the New River Company's supply, there had been positive decreases of population in Bishop's Stortford and Hertford between 1881 and 1891. At Luton there had been an increase in the same period from 17,000 to 30,000. He could not imagine that the results of taking water by the East London Company from the Lea Valley could have any prejudicial effect upon those urban populations. Luton was 13 miles away in a direct line. Stevenage was 8 or 9 miles, and Bishop's Stortford was 9 miles from the district of the East London Company. The estimate of 33 gallons per head was largely, he thought, in excess of what it ought to be. He should say that, including the trade supply of 6 or 7 gallons per head, for that class of property it ought to come down to 25 or 27 gallons.

The CHAIRMAN: Is that founded upon your knowledge of East London, or upon what an urban population similar in character ought to consume?

Witness: The fact that they take this quantity of water is obtained from what I am told, and from my knowledge of East London. Other Companies, as you will no doubt hear, are able to do better; and if the East London Company had the fair assistance of the authorities in insisting upon proper fittings and upon the supply not being abused, they would be able to do what I say without stinting anybody.

Mr. MANSERGH: What is your opinion with regard to the district being on a constant instead of an intermittent supply? Which takes the larger quantity of water?

Witness: I think where the consumers deal honestly and in reasonable fairness with the Company, the constant supply takes the least water.

The CHAIRMAN: As regards the River Lea, do you consider that the pollution which exists above the intakes of the East London Company, and which, to some extent more or less, but still to some extent, arises from sewage being conveyed into the stream from which the intake is derived, has any prejudicial effect upon the quality of the water, or an effect prejudicial for all possible purposes of consumption?

Witness: As regards the form in which the question is put, I should appeal to the facts, and say "No;" as an abstract proposition, "Yes."

Do you think any organic matter which finds its way into the raw material (that is, the water taken from such sources as I have indicated) can be undoubtedly taken out by filtration?—Organic matter I should say "Yes." I do not know that I have sufficient knowledge to say where organic matter begins or ends. Vegetable matter can be largely taken out; but if you are referring to pollution in the way of sewage, then all I have to say is that I wish that kept out as far as possible. But in so far as it is not kept out, I think one can appeal to the health of the district to show that no harm has arisen from it at present; and I should consider there will be less harm in the future than in the past, because greater and better efforts will be made to keep it out.

Professor *Boyd Dawkins*, examined by the CHAIRMAN as to the areas of chalk and impervious London clay within the Company's district, said the River Lea chalk area was 275 square miles in extent, including outlyers; and the quantity of water falling upon it was very considerable, depending upon the rainfall and the amount of percolation. One inch over this area would give 11,000,000 gallons a day. Looking at all the conditions of the case, there would be not less than 10 inches of rain per annum going into the chalk. The surface of saturation runs to a height of 400 feet in this area. A large quantity of water was derived from the deep wells sunk below the line of saturation. The area of Thanet sand belonged to the same geological system as the chalk; water passing freely from one to the other.

The witness was further examined in detail as to the geological strata of the district.

Mr. *W. Topley*, F.R.S., was examined by the CHAIRMAN as to the surface from which the East London Water Company draw their supply, at the point where the London clay is denuded, and where the gravel and sand overlie the tertiary formation. He said a great part of the water was derived from the tertiary sands. The wells in the Lea Valley might be largely increased.

Mr. *J. H. Barnes*, M.Inst.C.E., examined by the CHAIRMAN, gave evidence as to the flow of the Lea and the gaugings. He handed in a table showing from 1880 to 1891 the average monthly flow of the river at Field's Weir in cubic feet and the number of gallons per day. In September, 1891, the quantity was 21,800,000 gallons daily. He did not know what the navigation required.

Major *Lamorock Flower*, Consulting Engineer to the Lea Conservancy, was called; but his evidence was postponed, so as to be given with that of the other witnesses for that body.

Mr. *W. C. Young*, Consulting Chemist to the Lea Conservancy, said he had made analyses of the water for the East London Water Company, with special reference to this inquiry. There was now a considerable diminution in the organic pollution of the water; the samples taken from the River Lea in 1891 being very much better than those of 1884 and 1886. The remainder of this witness's evidence was postponed, as in the case of the previous witness.

The Commission then adjourned till yesterday, when the evidence on behalf of the Lea Conservancy was taken. It will be followed by that for the Companies drawing their supplies from the Thames, and also for the Kent Water Company.

EXHIBITIONS OF GAS APPLIANCES.

A four days' exhibition of gas ranges, heating-stoves, and other gas appliances, made by Messrs. Fletcher, Russell, and Co., Limited, of Warrington and London, was opened last Tuesday, in the Gladstone Hall, Chatham, under the auspices of the Rochester, Chatham, and Strood Gas Company. The general arrangements were made by the Company's District Superintendent (Mr. Walter Hole), and were highly satisfactory. In connection with the exhibition, Mrs. Charles Marshall delivered a course of cookery lectures which were thoroughly appreciated by crowded audiences; and at the last of the series, Mr. Hole fittingly closed a most successful exhibition by offering, on behalf of the ladies attending the lectures, their hearty thanks to Mrs. Marshall for the kind and sympathetic manner in which she had conducted her lectures, explained difficulties, and answered the frequent questions put to her. Mrs. Marshall briefly thanked the ladies present for the close attention they had paid to the lectures, which had made them so successful. An exhibition of stoves manufactured by Messrs. R. and A. Main, of London and Glasgow, was commenced last Tuesday at Beeston; and during its course Miss Thompson, Principal of the Nottingham and District School of Cookery, delivered practical lectures on high-class cooking. Under the auspices of the Shaftesbury Gas Company, Messrs. Darwin, of London and Glasgow, exhibited last week a collection of their various gas appliances in the Market House, which each evening was brilliantly lighted by Wenham lamps. The exhibition was opened by the Mayor on Tuesday, and was continued on the two following days. Miss Nicholls, of the South Kensington School of Cookery, gave practical lessons in the art of cooking by gas in the afternoon and evening of each day. The whole of the arrangements were efficiently carried out by the Gas Manager (Mr. E. Yates). Last week the Chard Gas Company had a very successful exhibition of gas appliances in the Corn Exchange in that town. The stove exhibits were supplied by Messrs. Richmond and Co., Limited, of Warrington and London, who were represented by Mr. A. Mead; and the general arrangements were carried out by Mr. F. Turner, Manager of the Gas Company. The exhibition was opened by the Mayor (Mr. A. Venables Kyrke), who was thanked by the Chairman of the Company (Mr. Willey) for undertaking the duty. Lectures on cookery were delivered by Mrs. Bennett; and on Friday evening the Mayor and Corporation and the general public partook, in the Town Hall, of a gas-cooked supper, which was a great success.

An Extraordinary Accident to a Gas-Meter.—Early last Wednesday morning, at Messrs. Russell and Sons' Peel Foundry, Derby, the lightning struck a flagpost on one of the out-buildings, and tore away a long strip of wood the whole length of the post. At the same time a loud report was heard in the store-room, where the gas-meter, a very large one, is situated, and a strong smell of gas, which soon made itself apparent, at once showed that something serious had happened. An investigation of the spot revealed that the meter had been displaced, and one side of it had been cut out as though with a knife. It is 3ft. 6in. diameter, and made of cast-iron ½-inch thick.

THE BIRMINGHAM CORPORATION GAS DEPARTMENT.

The Annual Report.

At the Meeting of the Birmingham City Council last Tuesday—the MAYOR (Mr. Lawley Parker) presiding—the annual report of the Gas Committee, the principal portions of which appeared in these columns last week, was submitted.

Alderman POLLACK moved—"That the Gas Committee be authorized to appropriate £22,144 2s. 1d., being the net profit of the Gas Department for the year ended the 31st of March, 1892, to the credit of the improvement rate of 1891." He said that, on the last two occasions on which he had presented reports of the Gas Committee, he had endeavoured to prepare the members to expect unfavourable results from the trading of the last financial year; and this for the obvious reason that, while the cost of coal had slightly increased, the price of coke, which was their chief residual, had to be reduced, and was certain to produce a less revenue than in the preceding financial year. Under these circumstances, it must be an agreeable surprise that the Committee were able to recommend that the sum of £22,144, which was but little short of the usual £25,000, should be appropriated to the improvement rate. It would be seen that, while the gross profits of the preceding financial year were £131,247, those of the year just ended were only £114,170—a decrease of £17,077. In examining as to the cause of this, it would be observed that the revenue from coke and breeze had been £20,423 less than in the preceding year; and this alone would account for even a larger decrease of profits. But there had been other unfavourable causes at work. It was true that, with respect to the sale of gas, they had an exceptionally good year; there having been an increase of £26,138, or a little more than 4 per cent. Under ordinary circumstances, this ought to have yielded them a very large profit; but if they looked at the debtor side of the account, they would see that there had been an additional cost of coal amounting to £20,448, and of wages in the retort-house of £4191. They had also to pay an additional £2859 for purification; and there were other items in which there was an increased expenditure of £586—making a total increased charge in respect of the production of gas of £28,085. He had already said that the extra revenue from the sale of gas was £26,138; and they had to add to this the additional profit on fittings, discount, &c., of £398—making together £26,536. Unfortunately, from this amount they had to deduct £19,417 deficiency of income from residuals, which reduced the surplus on the credit side to £7119. If this sum was deducted from the increased expenditure of £28,085, they found there was a net increase in expenses to produce the quantity of gas they had sold of £20,966. But this was in excess of the £17,077, forming the difference between the trading profit of 1890 and that of 1891; and they would doubtless ask him from what source he derived the difference of £3889. This would be found on the credit side of the revenue account under the head of discounts and adjustments. Last year the amount provided for that item was £19,519; but this year it had been reduced to £15,630. The reason for the reduction was that hitherto they had kept in reserve a sum equivalent to 7½ per cent. of the last quarter of the year's accounts, to provide for discounts and losses from bad debts. They had found, however, during the last few years that their losses from bad debts had been gradually decreasing, and were now very small. The present amount was only £711, as against £803 last year, and £1375 in 1887. Now, if they looked at the profit and loss account, it would be seen that the Committee had omitted to provide for the statutory instalment of the sinking fund, which in the past year amounted to £4217. Twelve months ago they were fortunate enough to be able to recommend, and he had the pleasure of moving, that the sum of £45,256 should be put to the credit of the sinking fund. This was a very large sum; and the Committee thought that, under the circumstances, there was no immediate necessity to increase this account. This omission enabled them to reduce the amounts provided for annuities and interest, and to make up the balance of profit for the year to the sum named in the resolution. Had it not been for this suspension of the statutory instalment of the sinking fund, and the reduction of the amount provided for discounts and adjustments, their profit for the year would have fallen to £14,037. It showed the wisdom of making reserves in the good years, that they might be able to fall back upon them in years of depression. The question was, How long would the depression last? How long would they be able to face it without resorting to an increase in the price of gas? This would entirely depend upon the contracts which they were about to make for coal and tar—contracts which would be completed within a few weeks. Not until then would the Committee be able to make a correct forecast of their income and expenditure, and say whether or not it was necessary to increase the price of gas. The Council knew full well that the Committee were most unwilling to take such a step, and that they would not take it unless they found it absolutely inevitable. In the meantime, he thought the members would give credit to the Committee for having had to face most adverse circumstances. Their coal bill last year was £271,000. Coal had risen greatly since 1888, when the average price was 8s. 8d. per ton, as against 12s. last year. Had they been able to buy coal in the last financial year at the prices of 1888, the difference to them would have been not less than £75,000. The wages for carbonizing, which in 1888 were £35,157, amounted last year to about £57,000. Taking into consideration the additional quantity of coal distilled, the additional wages paid in the retort-house alone, as compared with 1880, were £14,300. Yet, though they had this extra expenditure of nearly £90,000, the price charged for gas was the same as in 1888. There were some hopeful circumstances which they might take into consideration. For instance, there was the increase in the sale of gas, which last year amounted to 235 million cubic feet in excess of the preceding year. This was a larger augmentation than they had had in any year since the acquisition of the undertaking. The cause was, perhaps, a little difficult to explain; but it was no doubt due to a great extent to the large number of gas-engines which were being used, to the stimulus which was being given to the sale of cooking-stoves, and perhaps more than all to the severity of the weather in the quarter from April to Midsummer last year, and also from Christmas to Lady-day last, when they were once more "favoured" by cold and fog. As he had already said, the revenue from coke was about £20,000 less than that in the previous financial year; but otherwise it had been the largest amount which had been realized for that residual since the transfer to the Corporation. It compared well especially with the years 1886 and 1887, when their revenue from coke was only £35,000, or about half of the year under review. The reduction in revenue from coke was, on the whole much less than had been experienced throughout the country by the large gas companies. A great deal of fault had been found with them in respect of the accumulation of a large stock of coke at the works. This occurred before last winter, and was due to the stagnant condition of the cement industry, which had been one of their best customers. During the winter they had been selling coke as rapidly as they could make it and at the present time every ton of coke in stock on March 31, and all their summer make, was either contracted for or reserved for town sale, and the Committee believed that not more than 1000 tons, if as much, would remain on their hands at Michaelmas. Although the results of the year had not been as favourable as they would have liked, still he thought they could point with some pride to the results achieved by the Gas Department since the transfer of the works. The sale of gas had increased since 1876 from 2386 million cubic feet to 4045 millions, which was nearly 60 per cent.; while their capital expenditure had only risen from £2,084,000 in 1876 to £2,197,000 at the end of March last, or little more than 6 per cent. They had accumulated a sinking and reserve fund of £480,000—a sum by which their indebtedness would be practically reduced, were it not for the increased market value of the unredeemable annuities. The average price of gas, which stood at 2s. 11d. in 1876, had been for some years past 2s. 3d.—a difference which, calculated on last year's sale of gas, would have produced an additional annual revenue of £135,000. The sums that they had contributed to the improvement rate since 1876, including that mentioned in the present resolution, amounted to close upon £425,000, and yet the price which was charged for gas to the consumer was, with very few exceptions in some smaller towns, and no exception in the larger towns, the lowest in the United Kingdom—he might almost say throughout the world. They might, then, congratulate the city upon possessing an industrial undertaking conducted upon sound commercial principles, and with results advantageous alike to the ratepayers and to the gas consumers.

Alderman CLAYTON seconded the resolution, and it was carried.

Alderman POLLACK, in moving that the report be approved, said that the experiment of the Gas Oil Syndicate (referred to in the report) was being carried out at their own cost and risk, and the Committee were considering other processes for enriching coal gas by means of oil carburetters. Since the report was presented, the Committee had agreed to purchase the mains and distributing plant of the Sutton Gas Company, and to supply the parish with gas from Michaelmas next. The present proprietors would retain the site of the works, dismantling them and making use of the land. With reference to the cooking lectures given in Acock's Green, Handsworth, and King's Heath, by Miss Thwaites, of Liverpool, they had been an unqualified success. In each place there had been five afternoon and five evening lectures. The attendance of ladies at Acock's Green had been 1219, at Handsworth 2482, and at King's Heath 2056; and the lectures had resulted already in a large demand for cooking-stoves.

The motion having been seconded,

Mr. PRICE said he thought it a pity to make a ten years' contract for the sale of ammoniacal liquor at present, as the price of ammonia was lower than it had been for years.

Alderman POLLACK explained that the price of ammoniacal liquor under the contract would rise if the price of sulphate of ammonia went up.

The report was approved.

HALIFAX CORPORATION GAS UNDERTAKING.

The Rates and the Gas Profits.

The Halifax County Borough Council held a special meeting last Wednesday week to consider the estimates for rates for the current year, amounting to 5s. 2d. in the pound; and the discussion which took place mainly turned upon a proposal to increase the amount of profits handed over by the Gas Committee in aid of the rates. Alderman Bairstow moved the adoption of the estimates; and in the course of his statement, he told the members that the Gas Committee had decreased their expenditure by £1100, and increased their income by £1400; while the Water Committee had added £825 to their income. He did not anticipate that there would be any reduction in the rates, as, in the near future, they were going to incur a large expenditure on various works—among others, £200,000 on water-works; £100,000 on gas-works; and on electric lighting an "unknown quantity." Mr. Brook interjected a remark to the effect that the outlay on electric lighting would be £40,000. The motion having been seconded, Alderman Booth proposed as an amendment that the price of gas should be increased 1d. per 1000 cubic feet; and the estimates so altered that a rate of 5s. would suffice. He argued that there were some people who thought they ought not to have any profit from the gas-works; but to his mind it was an exceedingly foolish thing to think that they should have so much money invested in the gas-works, and yet it should not be looked upon as a trading concern. A man who did not use gas had just as much right to complain of another who had gas at cost price or less, as to say they had no right to pay rates out of gas profits. What they had expended on the gas-works ought to bear a reasonable return; and theirs was the only town in the West Riding that did not look to the gas-works for some profit. If they did not get profit out of the gas-works, where were they, he inquired, to look for the money with which to carry out improvements? He thought he was fair and moderate when he asked the Council to increase the price of gas by one penny. It was an amount that would not affect anybody—it would hardly be felt; and in fairness and justice to the general ratepayers, he considered the gas consumers ought to pay this increased amount. Alderman Pollard, who seconded the amendment, was of opinion that the time had come when they ought

to take profits from both the gas and water works. The proposal to raise the price of gas might, he said, affect some half-a-dozen firms; but they must occasionally adopt means of this kind in order that the rates should not be so changeable. The Chairman of the Gas Committee (Mr. Brook) followed with a few remarks, from which it appeared that it was only after a good deal of pressure that the Gas Committee had added £1400 as increased income; but where they were going to get it from, was more than he could tell. During the past eight or ten years, a very large sum had been taken from gas profits; the amount in the past year being £4000. In their estimates for next year, they had assumed that coal would cost 3d. or 4d. per ton less; but he could not possibly say whether the Committee would be able to realize that. They were pretty unanimous against an advance in the price of gas, believing that the undertaking was already doing its full share towards the rates. Alderman Midgley said that in 1880 the Council, after full discussion, arrived at the conclusion that the ratepayers should receive 1 per cent. towards the rates from the gas-works. He had gone back every year since to see if that arrangement had been faithfully carried out. One per cent. on the entire capital would be £30,000; but the amount they had received during that time was £60,000, or just about twice the amount agreed upon—being nearly 2 per cent. Including payments to the sinking fund, commissions, &c., he found that altogether, in the past twelve years, 7 per cent. had been taken out of gas profits. It had been asked who was going to pay for the improvements? He held that the ratepayers ought to pay for them; and if they owned the gas-works, as they did—and they ought to have a consideration for their ownership—he thought 2 per cent. was a very reasonable margin. Mr. Clayton remarked that he was utterly opposed to the principle of the Corporation having a cow to be milked, in order to cover the delinquencies and mismanagement of other departments, unless the maintenance of that cow was equally and fairly contributed to by all the ratepayers according to their position and rates. Alderman Booth said that a penny increase in the price of gas would be but a trifling difference to any. To his own firm, who were among the three or four largest gas consumers in the borough, it would represent an addition as nearly as possible of £35 a year, while in contrast to that there were hundreds—probably thousands—who would not be affected to the extent of a penny. This was neither equitable nor right. The amendment was rejected by 25 votes to 5; and the estimates were then approved.

BAHIA GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held at the London Offices, 9, Queen Street Place, E.C., last Thursday week—Mr. Edward Horner in the chair.

The Secretary (Mr. T. Guyatt) read the notice convening the meeting; and it was agreed to take the report and accounts as read. The former stated that the profit for the six months ending Dec. 31 last was £6845, which, added to the amount brought forward (£3168), made the sum of £10,013, out of which the Directors recommended the usual dividends on the preference shares, and a dividend at the rate of 8 per cent. per annum (free of income-tax) on the ordinary shares, which would absorb £6225. The Directors also mentioned that the period since the last meeting of shareholders had been one of constant anxiety to them and their officers. The Company's tender was sent in to the State Government of Bahia on Nov. 30, but was not opened until Jan. 12 last. It was then referred, with others received, to a Committee of Engineers to examine and report. As far as the Directors were aware, no decision had been arrived at with regard to the acceptance of any one of the tenders. The latest telegraphic advice from Bahia (April 26) was that an agreement had been entered into for the continuance of the supply of gas for three months after the 9th inst., when the Company's present concession would expire.

The Chairman, in moving that the report and accounts be received and adopted, said that the profit for the six months showed the satisfactory increase of £382, notwithstanding the enormous loss on exchange of £3407, as compared with £1261 for the corresponding six months of 1890. On examining the revenue account, it would be seen that, while there was a decrease in nearly every item of expenditure over which control could be exercised, there was at the same time an increase of receipts of £1376. These were the pleasing points in the accounts—viz., decreased cost and increased receipts. The per contras were the sums due by the State for public lighting and public establishments—together £14,382, as against £9782 in 1890; and the additional loss on exchange already referred to. The Company's Manager had been instructed to make urgent representations to the Governor in regard to the indebtedness of the State to the Company, and to insist upon an early settlement. The unsettled position of political and commercial affairs in Bahia for months past had operated against a settlement. A new Governor having been appointed, it might reasonably be expected that something would soon be done to reduce the excessive arrears. In the matter of the concession, which expired on the 9th inst., he did not propose to enlarge upon it, and it might be considered by the shareholders undesirable to discuss the point at length at that meeting.

Mr. Horatio Brothers seconded the motion.

Mr. Blundell said that, following the hint of the Chairman that probably it would be unwise to discuss at any length the question of the concession, he would not do so; but he thought there ought to be an expression from the shareholders of their deep disappointment at the very great want of courtesy—to say the least of it—which the Company had received from the State Government of Bahia. Unless the Brazilians showed very speedily a change of front with regard to English enterprise, English gold would cease to flow into the Brazils, and they would reap what they had sown—disaster and disgrace.

Mr. George Anderson said he should not have spoken but for the extraordinary circumstances which the Company were in. It appeared to him that the shareholders ought to support the Directors in every way they could, and not yield an inch of that which they were entitled to hold. The State Government were doing a very unjust and very impolitic thing; and the shareholders sympathized—he did most decidedly—with the difficult position in which the Directors found themselves. The shareholders should arm them with their support; so that they might act in every way to protect their property.

Mr. Jones said he quite agreed with what had been said as to the action of the Provincial Government; but he had the strongest reliance in the good faith of the Imperial Government of Brazil. With regard to the accounts, the Chairman had referred to the large sums due for public lighting and public establishments; but he would ask the shareholders to look at one little cheery aspect in the figures. Their Manager at Bahia had considerably reduced the amount outstanding for private rental. If they looked at the figures twelve months ago (December, 1890), it would be seen that they stood at something like £6720; as against £5390 at December, 1891. There was a reduction in the amount of indebtedness. Now, they ought to be proud of the man who could accomplish this in one year in Bahia. They should strengthen his hands and the hands of the Directors against the encroachments of politicians, and against that terrible tendency of people to run into debt and omit to pay.

The motion was carried unanimously.

The Chairman moved that a dividend for the half year ended Dec. 31 last, at the rate of 10 per cent. per annum upon the 10 per cent. preference capital, at the rate of 7½ per cent. on the 7½ per cent. preference capital, and at the rate of 8 per cent. per annum (free of income-tax) on the ordinary capital of the Company, be declared.

Mr. Horatio Brothers seconded the motion, which was carried.

Mr. Jabez Church proposed a vote of thanks to the Chairman and Directors for the way in which they had conducted their business during the past half year. They had heard that they should do all they could to support the Board; and he thought they were very much indebted to them and the gentlemen who had proved themselves so thoroughly able to conduct and carry on their affairs.

Mr. Machell seconded the motion, which was cordially agreed to.

The Chairman assured the shareholders that the Directors greatly appreciated the vote of thanks that had been passed. The matter of the concession had caused them a great deal of labour and anxiety; and they had had many discussions over it. He moved that the thanks of the shareholders be given to the officers in London and Bahia.

Mr. Horatio Brothers seconded the motion.

Mr. Guyatt returned thanks, and the proceedings terminated.

ODESSA WATER-WORKS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at the Cannon Street Hotel—Sir Peter Spokes in the chair.

The Acting Secretary (Mr. E. Allen) read the notice convening the meeting; and the report and accounts for 1891, from which a few particulars were given last week (p. 981), were taken as read.

The Chairman, in moving the adoption of the report and accounts, referred first to the defalcations of the late Secretary, Mr. W. D. M. Forrest (see *ante*, p. 864). He said he could quite imagine that the shareholders might be disposed to blame the Directors for having reposed so much confidence in one who had proved himself so unworthy of it; yet he ventured to think after all it was not very surprising that one who had been in the Company's service for 20 years, and entered it with credentials of the highest character for integrity and ability, and who had moreover made himself so familiar with the whole of the details of the Company's business from its earliest days, should have been entrusted to an extent that otherwise would not have been the case. The defalcations of the Secretary (for which he was now undergoing a term of six months' imprisonment) had been treated as an asset of the balance-sheet, under the head of suspense account; and he need only further say that the Directors confidently hoped that ultimately the Company would not suffer any loss. Dealing with the report and accounts, he was sure the shareholders must feel it was matter for congratulation that the net revenue for 1891 showed an improvement of more than £4000. If they took the Odessa accounts alone, then the improvement was shown to be nearly £6000—that was to say, the water-rents and miscellaneous receipts amounted to close upon £4000 over 1890, whilst the expenditure exhibited a decrease of about £2000; and during both years the 6-copeck rate had been taken and calculated for the household supply. It would be observed, however, that the rate of exchange during 1891 had not been so favourable as in 1890; and hence their remittances had not produced so much by nearly £2000 as in the previous year. It would have been gathered from the report that the lawsuits in Russia still formed one of the chief obstacles in the way of the shareholders getting something in the shape of dividend. Whoever, he asked, had heard of any country but Russia refusing to pay for the supply of water to the troops—an obligation which, if discharged, would be equal to 2 per cent. upon the "A" shares. Then the Municipality was endeavouring—and had endeavoured for some time past—to blackmail the Company (he used the term without any hesitation) in almost a similar amount, arising out of a claim for the cumulative fines in respect of cloudy water in 1881 (£10,500), which was caused through circumstances over which they had no control. Then there was a third case, which had reference to a reduction in the price of water, and which, if finally given against the Company, was utterly at variance with the language of the concession; and it would be tantamount to depriving the "A" shareholders of another 3 per cent. It might surprise the shareholders to learn that the Mayor had been desirous of re-opening friendly negotiations with the Company; and he had gone so far as to intimate that the concession might be extended for 28 years, although they would not consent to the raising of the price to 8 copecks. He had also hinted that they might be prepared to buy the undertaking, if the Company would accept deferred payments. (Laughter.) The Chairman then proceeded to point out the differences in the principal items in the revenue account in comparison with 1890; among them being a saving of £1400 in the cost of coal, due in some measure to the satisfactory results obtained from the new boilers at the Dniester station. With regard to the balance-sheet, the temporary loans were £2500 less than in 1890, and the balance at the credit of the capital account had quite

disappeared; while the contingency fund had been reduced by the amount affected by the decision of the Senate at St. Petersburg on account of the water supplied to the slaughter-houses, which they had decided should come out of the "gratis" water.

Sir ARTHUR T. F. CLAY seconded the motion.

Mr. WOOD criticized at considerable length the management of the Company. He submitted that the meeting was not a legal one, as, according to the Articles of Association, the ordinary general meeting should be held in April; and he intimated that he should retain his right to question in proper time the legality of the resolutions that might be passed. With regard to the defalcations of the Secretary, he inquired whether it was a fact, as reported, that it was an open cheque which was given to him. He also referred to the great fall in the value of the Company's shares since 1884. In that year Sir Francis Head was the Chairman, and he was blamed for the language he used towards the Russians; but he (Mr. Wood) ventured to say that he never used an expression so strong as that of "blackmailing." In 1884, the value of the shares was £5; but now they were not worth £1 10s.

Alderman Sir J. C. LAWRENCE, referring to the criticisms of Mr. Wood, pointed out that the circumstances of 1884 had since been entirely altered, and that the Directors were now pursuing the policy which was indicated by the Committee who were appointed by the shareholders in October, 1890, to confer with the Directors on the position of the Company. The opinion of the Committee was that the Company had a concern which was gradually increasing in value; and if no untoward circumstance happened, there would be an improvement in their position. His anticipations had been more than realized during the past year. The price of the water was lowered in 1890 to the extent of £2000. But they had recovered all that in one year; and the demand was still increasing.

Mr. CHESTER, Mr. THOMAS, and Mr. BATLEY also addressed the meeting; the last-named gentleman inquiring whether the Directors had a guarantee policy in connection with the officials who had the handling of the Company's money, and, if not, whether they would get guarantees as quickly as possible.

The CHAIRMAN, in reply to a question as to the likelihood of the Municipality purchasing the undertaking, said that in September, 1893, they had the absolute right of pre-emption upon the net revenue on an average of five years. With regard to the inquiry as to guarantees in connection with the Company's officials, they had none at present; but the shareholders might take it that this was a matter which would receive the attention of the Board. The cheque to which reference had been made was an open one.

The motion was then carried.

The retiring Directors (Sir Peter Spokes and Mr. D. H. Goodsall) were re-elected. Mr. G. E. Francis also offered himself for election as a Director; but he received little or no support from the shareholders.

The Auditors (Messrs. W. B. Peat and Co.) were also re-appointed, after a brief discussion, in the course of which it was elicited that the defalcations of the late Secretary up to Dec. 31 last amounted to £1000.

The proceedings then terminated.

METROPOLIS WATER SUPPLY.

The Quality of the Water in April.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 180,921,835 gallons. as compared with 174,273,526 gallons in the corresponding month of 1891; being at the rate of 29·6 gallons per head of the population, Of the entire bulk of water sent out, 91,255,469 gallons were drawn from the Thames, and 89,666,366 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent (Orpington Well), 0·4; Kent (Deptford), 0·7; Tottenham and New River, 1·2; Colne Valley, 1·5; East London (deep-well), 2·0; Chelsea, West Middlesex, and Grand Junction, 2·3; Southwark and Lambeth, 2·4; and East London (river supply), 2·6. The water abstracted from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was, for river water, of a high degree of organic purity; the river being fed during the dry season chiefly by springs in the chalk and oolite. It was efficiently filtered before delivery. The water taken chiefly from the Lea by the New River Company ranked with the deep-well waters as regards organic purity; while that supplied from the same source, but lower down the stream, by the East London Company, was slightly inferior to the Thames waters. Both supplies were efficiently filtered. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of good quality for dietetic use; that of the Kent Company, both at Orpington and Deptford, being especially distinguished for high organic purity. The Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and Tottenham waters were clear and colourless; the New River and East London (deep well), clear and nearly colourless; while the remaining waters were clear and very pale yellow. The bacteriological examination by Dr. Koch's process of gelatine plate culture gave the following results: One cubic centimetre of each water, collected on the same days as the samples for chemical analysis, developed the following numbers of colonies of microbes: Kent, 8; New River, 10; West Middlesex, 12; East London (river supply), 20; Grand Junction, 32; Chelsea, 52; and Southwark, 54."

Messrs. Crookes and Odling, in the course of their report to the Official Water Examiner for the Metropolis (General A de Courcy Scott) on the quality of the water supplied by the London Water Companies in the past month, as shown by samples taken daily for analysis, say: Of the 168 samples examined, the whole were found to be clear, bright, and well filtered. The satisfactory condition of the water supply to the Metropolis exhibited throughout the preceding months of the year has been more than maintained during the past month. But, in respect to the results indicative of the nearly always minute proportion of organic matter present in the water, so long as the figures continue low, too much stress must not be laid on their monthly, or even weekly, variations. According to the more or less favourable meteorological conditions affecting the river from time to time, these figures will vary more or less, and have, during the past month, proved to be exceptionally low. Thus, taking the Thames-derived water for comparison—and a similar result is apparent in the case of the New River and East London Companies' supplies—the mean amount of organic carbon present in the April supply was only 0·125 part in 100,000 parts of the water, as against a mean for the January supply of 1·058 parts, and a mean for the first three months of the year of 0·146 part in 100,000 parts of the water. But even as between the January and April supplies, the difference in the mean proportions of organic carbon present, or 0·033 part in 100,000 parts, is quite immaterial; corresponding as it does to about the 1-17th part of a grain of organic matter in a gallon (*i.e.*, 70,000 grains) of the water. A comparison, in the case of the Thames-derived supplies, of the results obtained during the past month, and the mean results afforded by the previous three months, is given below; but the notably low figures furnished by the past month's supply one can scarcely expect to be continuously maintained:—

	Ratio of Brown to Blue Tint. Means.	Oxygen required for Oxidation. Means.	Organic Carbon per 100,000 Parts. Means.	Organic Carbon per 100,000 Parts. Maxima.
First three months	9·8 : 20	0·045	0·146	0·204
April	5·6 : 20	0·045	0·125	0·204

Mexborough and Swinton Gas Company.—In connection with the proposed purchase of this Company's works by the Local Authorities, it is interesting to note that a dividend of 5 per cent. has recently been declared. The sum available for this purpose on the past year's working was £757; and to pay the 5 per cent. necessitated the withdrawal of rather more than £200 from the reserve fund.

The Rhyl Improvement Commissioners and the Gas-Works.—At a recent meeting of the General Purposes Committee of the Rhyl Improvement Commissioners, a communication was read from the Local Government Board with reference to the application of the Commissioners to borrow £35,000 for the purchase and extension of the gas undertaking. It stated that the Board, before giving a final decision, desired the Commissioners to reconsider the matter. Bearing in mind the improvements and repairs necessary, in order to place the plant in an efficient and satisfactory condition, they were inclined to the opinion that the acquisition of the works would not be to the advantage of the town. In any event, they would not be prepared to sanction the loan for more than 25 years. The Commissioners asked that the repayment of the loan should be extended over 50 years; and their calculations were based on the assumption that this length of time would be granted.

Another Water-Meter Case.—Last Thursday week, at the Barnsley County Court, the Deane Valley Water Company sued Mr. A. M. Chambers, the owner of ithe Hyland Brick-Works to recover the sum of £44 11s. 6d. for water supplied in the last quarter of 1890. It appeared that defendant had been furnished with water by meter since December, 1883; and it was not until January, 1889, that any complaint was made. The state of the meter was taken monthly by one of the Company's inspectors, who in the first place entered the figures into a small book, and then copied them into a large one. The inspector was called; and in cross-examination he admitted that, when he came to make his report at the end of the month, he found the figures faint, and he repencilled them, but did not add to them. On the part of the defendant, evidence was given showing that the meter had been tested; and it was absolutely impossible to use one-tenth of the water charged for. His Honour held that consumers were at the mercy of gas and water companies; and great care ought to be taken that figures were not tampered with by servants in any way. He gave a verdict for the defendant with costs.

Monte Video Gas Company, Limited.—The shareholders of this Company will meet to-day to receive the report of the Directors on the operations of the year ending Dec. 31 last. The net profit, as shown by the revenue account, was £36,478, which sum has been placed to the credit of profit and loss. From this latter account, provision has been made for interest on debentures, for income-tax, and for bad and doubtful debts, and £1632 has been written off capital expenditure for depreciation. The balance then remaining available for dividend is £35,123. Of this the Directors paid on Nov. 23, 1891, an interim dividend of 10s. per share, free of income-tax; and they now recommend the payment of a further amount of 10s. per share, also free of income-tax, making together a dividend of 5 per cent. for the year. This will absorb the sum of £27,096, and leave a balance of £8027 to be carried forward. The year, it appears from the report, was marked by great depression and a complete stagnation of business in Monte Video. Not only was there a stoppage in the erection of new buildings, but many important establishments were compelled to close their doors; and in the autumn of the year, it was reported that at least 1000 houses remained unoccupied. This reaction from the prosperous conditions of 1889-1890 seriously affected the Company's revenue from all sources. As against these adverse circumstances, the long-continued depression in many branches of trade on this side enabled the Directors to make purchases on very favourable terms, and to deliver the coal and other material at exceptionally low rates of freight. A profit also was realized in the exchange on remittances to London of £636. Although the Company's contract with the Municipality for the public lighting of the city remains unrenewed, since the beginning of the current year, at the request of the authorities, they have lit with gas 31 additional lamps. The Directors have the satisfaction of reporting that the current indebtedness of the Authorities is being regularly discharged.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

For my purposes, the times are bad just now. I scarcely remember ever having so much difficulty in procuring material out of which to furnish you with a few "Notes" upon gas matters in Scotland as I have had last week and this. Probably, it is but the lull before the storm. The financial year with most of the gas-supplying bodies has come to an end; and meanwhile office-staffs are busy getting the books of their undertakings balanced. So far as can be seen, there are to be comparatively few good tales to tell when the annual statements are made. The high price of coal laid the foundation for hard times, even at the beginning of the year; and to it has to be added the great fall in the price of residuals which has been experienced. With dear coal, the price of gas was pretty generally raised; and this has told on the consumption. There has accordingly been, not only a lower price for secondary products going, but that smaller price has been realized upon a diminished quantity; and so companies and corporations have been pinned in a double form. While prepared to learn that advances are not the order of the day, in the matter of the amount of business, I do not, however, anticipate that there will be anything serious to record, or indeed anything more than a temporary check upon the general advance that has been experienced during the past few years. That anything more than this is not to be looked for, is shown by the fact that there is scarcely a gas-works of any magnitude in connection with which arrangements have not been made for extensions of some sort or other. Edinburgh is perhaps the most conspicuous exception; for there, though the subject has been discussed, and the need for extension is admitted, it has been resolved not to go on with the work in the meantime—a policy the wisdom of which is open to question. A sudden upward bound in the consumption, which may arise any day, would certainly place the Gas Commissioners in an awkward fix. But in Glasgow, Paisley, Dundee, Aberdeen, and Inverness—all Corporation-owned undertakings—measures for the extension of the works are either in process of being carried out or are under arrangement. There seems to be a disposition to hold over the fixing of coal contracts as long as possible, in the expectation of a further fall in prices—an expectation which there is every likelihood will be realized. The coal owner has had the best of the bargain for the past three years; now the scale seems to be turning against him. I notice this week that the Niddrie and Benhar Coal Company is able to pay a dividend at the rate of 10 per cent., a result which has been attained largely on account of the good prices which have been got for cannel. It is not out of place here to refer to the position of the oil trade in Scotland, seeing that oil is the heaviest competitor with gas. Several oil companies have been holding their annual meetings; and the opinion of the chairman of one of the companies—the Linlithgow—is that their trade is not in a satisfactory position. Competition with petroleum-producing countries is keener than ever; and prices are, on the average, lower than they have been since 1887. A year ago, consumption was ahead of production; but that is not the case now. The best remedy, he considered, was to curtail the output; but unfortunately united action to bring about this result had not been obtained. With the oil trade in that position, there need be no wonder that the gas industry should also be less lively than usual; but the fact that oil stocks are accumulating, shows that that trade is not encroaching upon gas, and that any diminution in the volume of gas consumed is not due, to any large extent, to its place being taken by oil. In the oil trade, the high price of coal and chemicals, and the high rate of wages, are blamed for the bad results. Wages have, however, been recently reduced, from which a considerable measure of relief is anticipated. The question arises whether, if wages in competing trades are being lowered, a corresponding movement may not be necessary in gas-works. So far, I have not seen such a step suggested; but if times continue as they are, it must come up. It would be unfair to go on throwing all the burden on consumers. Very substantial increases were made to the wages of the gas workers within the past ten years, in nearly every instance without dispute; it remains to be seen whether the workers will take as kindly to a reduction as their employers did to the increase.

The Dundee Gas Commissioners have found, on balancing their books, that they are left with a debit balance of £4780. This is the third year in succession that they have been in the position of not being able to make ends meet. Their first debit was £73; last year, it was £2381. Deducting the debit balance of a year ago, the loss on the past year's working was £2399. The result must be rather disappointing, because the estimate was that there would be a balance of £400 of profit. The loss has arisen chiefly on account of the fall in the price of residuals. When the year began, no change was made in the price of gas, which was retained at 3s. 8d. per 1000 cubic feet. Had the Dundee Commissioners followed the course adopted in most places, and raised their price, the balance would have been on the right side. It is now proposed to raise the price by 1d. per 1000 cubic feet; and it is mentioned that no increase in the consumption is expected. The quantity of the output for the past year, as stated in these "Notes" on May 10, was 34¼ million cubic feet larger than in the preceding year, which again was 48½ million cubic feet more than in the year preceding that. Last year, too, the gas revenue increased by £4854; so that, apart from the fall in the price of residuals, there were all the elements for a satisfactory termination of the year—no increase in the price of gas, a larger output, and cheaper coal. There is this satisfaction, that the debit does not arise through any failure in the manufacture or the demand, but from a state of matters which affects all gas-works alike, and not gas-works alone but other industries as well. The annual meeting of the Gas Commission will be held about three weeks hence; and then, if not before, a fuller account of the balance-sheet will be obtainable.

At the meeting of the Aberdeen Corporation Gas Committee on Wednesday, tenders for the supply of coal were opened, and handed over to Mr. Alex. Smith, the Manager, to report upon. Several of the members urged that the illuminating power of the gas should be reduced to from 20 to 24 candles, to enable them to buy cheaper coal. Nothing was resolved upon; but the proposal will probably not be lost sight of. The illuminating power now is 23 to 24 candles.

Since I wrote a fortnight ago that Mr. Cuthbert, Gas Manager at Dunbar, was having the best of it in the difference between him and his employers, the Town Council, affairs have taken an unfavourable turn for Mr. Cuthbert. For some reason, which is not explained, he has sent in his resignation; and at a special meeting of the Council on Monday night, it was accepted. It was resolved to ask Mr. Foulis, of Glasgow, to recommend a suitable man for the post. Mr. Cuthbert is an old man; and the Town Council is a young body as Gas Commissioners. They have never yet settled down to work; and whether rightly or wrongly, they seem to throw the blame on Mr. Cuthbert. I fancy the condition of the works has more to do with the discontent of the Commissioners than any defect on Mr. Cuthbert's part. They will, in all probability, find that a new man, if he is not to compromise himself, will insist upon a large outlay before he is satisfied to go on. The post is only worth £70 a year with a free house and the usual allowances.

The Dundee Police Bill has this week passed a Committee of the House of Commons. One of the clauses in the measure upon which evidence was heard was that which gives power to the Police Commissioners to require the owners and occupiers of tenements to light the common-stairs leading to them. The provisions are similar to those in force in Edinburgh, which, by the way, do not give entire satisfaction. A penalty of 40s. for failing to light was proposed; but objection was stated on behalf of the Department of the Secretary for Scotland that the sum was too high, and the Committee reduced it to 20s. Otherwise, the clause as proposed was approved of.

During the past week, a lively discussion has been proceeding in a Glasgow newspaper between Mr. Wm. Key, late Manager of the Tradeston gas-works, and several gentlemen, on the subject of the method of ventilation employed in the Glasgow City Chambers and the Victoria Infirmary. Mr. Key is the inventor of the ventilating system of the Victoria Infirmary; and he complains that the keeper of the City Chambers has adopted his method. He has protected his invention; and he appears to threaten litigation upon the dispute. Mr. Key, it will be remembered, resigned his post at the gas-works in order that he might take up the work of ventilating engineer. His method consists of washing the air by means of screens, and the controversy appears to be over the manner of placing the screens; but, of course, if the matter finds its way into the Law Courts, that may not be the point which will be raised by Counsel.

An augmentation scheme for the water supply of the town of Largs has been completed, at a cost of £4000. The engineer was Mr. W. R. Copland, of Glasgow; and the contractor, Mr. James Miller, of Kirkintilloch. The works consist of a weir on the Nodsdale water, and 1½ miles of iron piping, by which the water is conveyed to the present source of supply at Whittlieburn, and thence by a conduit about half a mile long to the reservoir at Middleton. The cost of the original works was £16,000.

A Select Committee of the House of Lords this week had before them a Bill by the Glasgow and South-Western Railway Company for powers to make a line of railway from Dalry to Fairlie, which is intended to shorten their existing line to the Ayrshire coast towns. Opposition was offered to the measure by the Corporation of Irvine as Water Commissioners, on the grounds that the railway, passing through the gathering ground, would be likely to cause a large abstraction of water; and that if town manure were to be conveyed by the railway very serious results might follow, as fever germs might be carried into the Commissioners' reservoir. The opposition, though supported by the evidence of Mr. Reid, Mr. Hawksley, and Dr. Littlejohn, was rather far-fetched; and the Committee passed the Bill.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 28.

Sulphate of Ammonia.—The market generally seems steady; and £9 17s. 6d. remains the quotation at country ports. London is reported easier. The shipments from Hull show a little improvement; and those from Liverpool are on a very fair scale. Still an advance in price seems impossible; buyers being apparently determined to combat any such attempt. Viewing the position generally, it may be taken for granted that prices will remain stationary for the present; and it is to be feared that, while speculators anticipate a lower range in the future, and act accordingly, an improvement must not be looked for by manufacturers. Like Pandora's box, the market has had many surprises in store; but a hopeful future need not be given up entirely, as it is clearly to be seen from the present reduction of stocks, that there is no over-production, and thus the greatest danger to the safety of any market is disposed of. The Scotch producers unfortunately, by their committing themselves so far ahead, damage the chances of the market greatly; and if sulphate was sold only as produced, not so much scope would be afforded to speculative operations. Nitrate is quiet, but steady, at 8s. per cwt.

LONDON, *May* 28.

Tar Products.—The lessened production is now making itself felt in market values. Even with the improvement which is distinctly perceptible in benzols, coal carbonizers will still find business unprofitable. It is expected that the production of benzol by carbonizers will shortly cease, until the price of benzol improves. These remarks, however, do not apply to benzol produced from coke-ovens—the conditions of manufacture there being entirely different. Business is reported in 90's benzol at 1s. 9d.; while 1s. 8d. fails to bring sellers. Stocks are remarkably low; and there is undoubtedly a better future for the article. Pitch is nominally quoted at firmer rates; but buyers expect to purchase their requirements at less money. Meantime very little new business is reported. There is more inquiry for creosote and heavy oils. But there are large stocks of both in existence; and it is not expected that prices will be much increased. Carbolic acid products are more easily saleable at a shade better prices. A steady business is being done in anthracene; but at very low rates. The following business has been done: Tar, 10s. to 12s. 6d. Pitch, 27s. to 29s. Benzols, 90's, 1s. 9d.; 50's, 1s. 4½d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 8d. Creosote, 1d. Naphthalene

salts, 20s.; pressed, 45s. Carbolic acid, crude, 60's, 1s. 1d.; 70's, 1s. 4d.; crystals, 5d. Cresol, 8d. Anthracene, 30 per cent., "A" quality, 10½d.; "B" quality, 7½d.

Sulphate of Ammonia.—More business is being done; but there seems no hope of any improvement in price this season. Sales are reported as low as £9 15s., less the usual discount; but £9 17s. 6d. is perhaps nearer to-day's value. Gas liquor (10-oz.) is quoted at from 5s. to 6s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A generally slackening demand continues to be reported for all descriptions of round coal throughout this district, with an easier tendency in prices. The best qualities, of course, are necessarily in lessening request for house-fire purposes. Selling prices are rather easier in many cases; and do not average more than 12s. to 12s. 6d. for best Wigan Arley, 10s. to 10s. 6d. for Pemberton four-feet and second qualities of Arley, and 8s. 6d. to 9s. for the common descrpitions of round coal suitable for house-fire consumption. The lower qualities of round coal are becoming more difficult to move for iron making, steam, and general manufacturing purposes; whilst requirements for shipment continue very indifferent, and there is a good deal of pressure on the part of buyers to secure concessions in price. This, no doubt, is in a large measure due to the reduction in the contract prices for locomotive fuel, referred to in last week's report, and which it is now evident will regulate the prices at which the Railway Companies will be able to cover the remainder of their requirements in this district. At the pit mouth steam and forge coals for inland requirements may be bought, without difficulty, at 7s. 9d. to 8s. 3d. per ton; whilst for shipment ordinary descriptions of steam coal are offering freely at 9s. 3d. to 9s. 6d. per ton, delivered at the Garston Docks, or the High Level, Liverpool, although for some special qualities collieries are firm in holding to about 10s. to 10s. 3d. per ton. The chief matter of interest just now in the coal trade is, however, the approaching renewal of contracts for gas coal; and tenders for several of the large local contracts have already been sent in. So far as the principal collieries throughout Lancashire are concerned, a strong determination has been expressed to adhere firmly to the basis of the prices obtained last year, which averaged 10s. to 10s. 6d. for best qualities and 9s. to 9s. 3d. for the inferior descriptions of gas coal at the pit mouth; and a resolution to this effect was actually passed at a meeting of the principal colliery owners, held recently, who practically bound themselves not to send in tenders under the current prices obtained in 1891. Of course, this did not bind the whole of the collieries throughout Lancashire; and in some instances there have been slight concessions up to 3d. per ton upon last year's quotations, but as a rule this has so far been only very slight, and for comparatively small quantities. Perhaps the most important contract so far placed is that for Preston, in which I understand supplies were secured at prices slightly under those paid last year; but in this particular instance, the 1891 contracts were placed rather early, and before gas-coal prices actually began to give way, so that the price which has been paid upon the renewal of contracts for the ensuing season is practically on the basis of the current prices which ruled with regard to the bulk of the contracts placed last year. Some sort of joint action is being attempted between the principal colliery owners of Lancashire and Yorkshire, who have held a meeting at Sheffield with a view of coming to some arrangement between the two counties with regard to this year's gas-coal contracts; but how far the policy of holding strictly to last year's prices will be adhered to, remains to be seen. Already, as I have indicated, there is some slight breaking away, which is having a weakening effect by inducing buyers of gas coal to hesitate in closing contracts, and to be more pressing about obtaining concessions before they accept supplies. With regard to engine classes of fuel, the market is fairly steady, owing to the absence of competition from Yorkshire; and although here and there sellers have been willing to take low prices to effect clearances, generally late rates have been held to pretty firmly, and supplies of good qualities are in most cases moving away without difficulty. At the pit mouth, burgy averages 6s. 8d. to 6s. 9d.; the better qualities of slack, 4s. 9d. to 5s. 3d.; and inferior sorts, 3s. 3d. to 3s. 9d. per ton.

Northern Coal Trade.—There has been a fuller supply of coal in the north-east during the last few days; several additional "unassociated" collieries having got fully to work. The Northumbrian collieries are producing very well; and thus the supply of coal has been very considerably increased. Best Northumbrian steam coal is easier, in consequence; the price generally quoted being 11s. 6d. per ton, f.o.b. in the Tyne, whilst for forward delivery a much lower price is taken. Household coal is extremely dull. Durham coal varies very greatly in price for prompt delivery, for the collieries that have been at work during the last few days are turning out comparatively large quantities; and thus the "fancy" prices that were asked are being now no longer paid. Bunker coals are lower—11s. having been accepted for increased Durham qualities, whilst further falls in price are likely to take place. Manufacturing coals are affected in price by the vast supplies of both Scotch and Yorkshire coal brought into the market; and in consequence lower rates prevail. Coke is dear—22s. being still asked for best blast-furnace qualities; but gas coke is fairly abundant. The collapse of the Durham miners' strike is looked upon at the time of writing as inevitable; for the funds of the miners are vanished, and they have no public sympathy. Miners in other districts are making strenuous efforts to induce the Durham men to fight on, for obvious reasons; but whatever the result of the voting in the aggregate, sections of the men will soon be at work.

Scotch Coal Trade.—Business last week may be said to have been of the waiting order. Very little forward demand exists, nearly all the business done being for prompt delivery. The miners have in nearly all cases accepted the reduction of wages. But they are working leisurely; and this, with a continuance of the activity in shipping, prevents stocks accumulating. Most of the shipping trade is foreign; but a good deal has been done with North of England ports. Traders continue to complain of a scarcity of waggons. The prices quoted are: Main, 7s. 9d.; ell, 8s. 6d.; splint, 8s. 3d.; and steam, 10s. to 10s. 3d. per ton. The shipments for the previous week were again abnormally high—the figures being 186,324 tons; an increase over the preceding six days of 2289 tons, and over the corresponding week of last year of 34,683 tons. For the year to date, the total shipments have been 2,662,151 tons, which is an increase over the same period of last year of 353,775 tons.

Public Lighting of East Ardsley.—It has been decided by a vote of 274 ratepayers against 123 to light the streets of East Ardsley by gas.

Droitwich Corporation Gas Undertaking.—The balance-sheet of the Droitwich Corporation Gas Committee for the past year shows that they received £1648 from the sale of gas; £420 for public lighting; and £268 for coke. The amount of gas sold was 7,609,600 cubic feet; being an increase of about 807,000 feet.

Liversedge and the Bradford Water Bill.—At the meeting of the Liversedge Local Board on Monday of last week, a formal report of the proceedings before the Committee of the House of Commons with reference to the Board's opposition to the Bradford Corporation Water Bill was made by Mr. R. A. Sheard, who also dealt with the effect of clauses added to the Bill on the previous Friday, by which the Corporation have undertaken to purchase the water-works plant of the township, and to distribute the water on the terms in force within the borough. He showed by a comparison of the Bradford charges with those at present in force in the township, that about £560 a year would be saved to the township in respect of 1500 cottages rated at £5 or less, and a further £150 in respect of houses rated at from £5 to £10, and that manufacturers, who have hitherto paid not less than 1s. 3d. per 1000 gallons and up to 1s. 11d., would pay not more than 9d. to Bradford. Occupiers of better-class houses, rated at from £10 to £60, would, on the other hand, pay a little more under the Bradford scale. The Chairman (Mr. Wharton) remarked that the total saving to the township under the Bradford scale was estimated at £1000 a year. Further discussion of the subject was reserved for committee.

Improvements at the Smethwick Gas-Works.—Last Thursday, Mr. T. Codrington, one of the Local Government Board Inspectors, attended at the Public Buildings, Smethwick, for the purpose of holding an inquiry relative to an application made by the Smethwick Local Board for sanction to borrow an additional sum of £9000 to defray the cost of alterations and improvements at the gas-works. The Clerk (Mr. E. Docker) explained that the gas-works were erected in 1882, and since that time the Local Board had not found it necessary to add to their capacity beyond making some slight additions. The population of Smethwick had risen 44 per cent. during the last ten years, and the number of houses in the place was rapidly increasing. The rateable value of the township was £136,241. The manufacture of gas at the works when they were opened was 123,693,000 cubic feet per annum; at the present time it was 154,495,000 cubic feet. In consequence of increase of population, and the resultant extra demand for gas, the works were being taxed to their utmost capacity. It was proposed to apply the £9000 in the following way: The provision of a new retort-house, to be worked on the regenerative system, which would cost about £5300; the other objects of expenditure including a condenser, exhauster and engine, washer, station meter, manager's offices, mess-room for the men, meters, and mains. The Gas Engineer to the Board (Mr. B.W. Smith) stated that the present producing capacity of the works was 154 million cubic feet of gas per annum. They were only intended to turn out 150 millions; but by careful management the yield had been increased 4 millions. The additions and improvements would cover a period of 15 years, or an increased production of 50 per cent. The Secretary (Mr. T. Sturgess) explained that the Board were authorized, under their Provisional Order, to borrow a further sum of £20,000 with the sanction of the Local Government Board. The Inspector visited the gas-works.

Local Opposition to the Birmingham Water Bill.—A meeting of the opponents of the Water Bill of the Corporation was held at Birmingham last Tuesday. The Chairman (Mr. E. Chesshire) contended that the scheme for obtaining water from Wales was a huge mistake as an engineering, a sanitary, and a financial question. Professor Wanklyn stated that Birmingham had in her possession a daily supply of about 10 million gallons of deep-spring water, derivable from springs underneath and adjacent to the city. The water-bearing strata of the locality yielded water which was well known to be excellent from a mineral point of view. Referring to the Bill, he said he had been particularly struck by the extraordinary reticence of the scientific witnesses before the Parliamentary Committee respecting the quality of the water from the Welsh gathering-ground. That the water contained very little mineral matter, and was soft, was almost the sum total of their evidence. Beyond that, though there was a perfect wilderness of figures, there was no information. If it should turn out to be true that the bulk of the Welsh water was peaty, the outlook for Birmingham would be bad; and the cost of the scheme would be greatly increased by the necessity for additional filters. The region of the gathering-ground in Wales was pre-eminently metalliferous; so that Birmingham people would run the risk of being poisoned by lead off the ground, and the further risk of being poisoned by lead dissolved off the pipes. For the first, there was no remedy; for the second, there was a remedy, but it would be costly and require constant vigilance. An analysis of the water showed that it contained half a grain of lead in a gallon; but the gentleman who made the analysis was not called as a witness for the Bill. Professor Hull expressed his belief that Birmingham was standing on the verge of a very serious catastrophe. No one was better convinced of the absolute necessity for an abundant supply of water to such a town than he; but it was also his opinion, founded on an experience of 35 years, that there were in the vicinity of Birmingham sources of supply capable of giving water of the finest quality for the next 100 years. Mr. Samuel Lloyd, Mr. Wilson Lloyd, and other gentlemen also addressed the meeting; and then a resolution was passed condemning the Welsh scheme and expressing the earnest desire of those present that it should not be further proceeded with.

Imperial Continental Gas Association.—The offices of this Association have been removed to No. 21, Austin Friars, E.C.

A New Water Scheme for Penrith.—The Water Committee of the Penrith Local Board has lately had under consideration a report made by Mr. G. F. Deacon, C.E., on the defective water supply of the town. Mr. Deacon points out that the volume of water pumped on the average for the supply is about 450,000 gallons a day, out of which 80,000 gallons are sold for trade purposes, leaving 370,000 gallons for domestic consumption and leakage. On the population of the town, this gives an allowance of more than 42 gallons per head per day. The proposed works, he estimates, will cost £8000.

Extinction of the Lucigen Light Company.—A circular has been sent to the share and debenture holders in the above Company, stating that, in order to protect the interests of the latter, the Directors have been compelled to present a petition for winding up. This step has, it is said, been forced upon them by the action of the Solicitors for the Company from its promotion in 1887 until 1890, who have served a writ on the Manager for about £730 for their bill of costs. As the Company are unable to pay the debt, the only course open for the Directors was to take the steps they have done.

The Sevenoaks Local Board and the Water Company's Works.—The Directors of the Sevenoaks Water Company have informed the Local Board that they decline to name a price for their works, as this cannot be done without the consent of three-fourths of the shareholders present at a general meeting; and that they also decline to enter into any agreement for the sale of the works at a sum to be fixed by arbitration. The Local Board have answered this, to the effect that, as the Company will not go to arbitration, the Board are disposed to make an offer of purchase; and, with a view to so doing, they have asked permission for their Engineers to view the property.

South-West Suburban Water Company.—The report of this Company for the six months ending the 25th of March states that, comparing this half year with the corresponding one of 1891, there has been a decrease in the working expenses of £744, which has been owing to the adoption of the new engine, filter-beds, &c., which have come into full operation, and an increase of revenue of £685. The Directors believe they have now reduced these expenses to a low limit; and that they will only increase in proportion to the rise in the revenue. The works, plant, and machinery of the Company have been fully maintained, and are stated to be in good working order. The water supplied by the Company continues satisfactory. The Directors have used their utmost endeavours to improve the position of the Company, and they continue to ask for the confidence of the shareholders.

Young's Paraffin Light and Mineral Oil Company, Limited, intimate that their books for the financial year ending April 30, 1892, after expending £25,774 for maintenance and repairs of works, pits, and mines—subject to audit—show a profit on the year's operations of £64,734. Adding the balance from last year—viz., £5138—and deducting £1965 for dividend paid, less interest, on £72,987 of debenture stock converted during the year, there is a total of £67,908. From this sum deductions have to be made for interest on mortgage debenture bonds, &c., and on 6 per cent. convertible debenture stock, leaving £43,111, out of which the Directors recommend that a dividend of 5 per cent. be paid to the ordinary shareholders in equal proportions, on June 20 and Dec. 19, less income-tax. These payments will absorb £16,980, and leave a balance of £26,131. From this balance it is recommended that the sum of £23,364 be written off in extinction of the "Pentland retorts account," which will leave the sum of £2767 to be carried forward.

Sales of Stock and Shares.—Last Wednesday, at Bristol, Messrs. Nichols, Smith, and Alder offered for sale by public auction, £20,000 of new debenture stock in the *Bristol Gas Company* created under their Act of 1891. The stock, which was put up in lots of £100, bears interest at the rate of 4 per cent. per annum. The result of the sale was as follows: 14 lots were sold at £104 5s.; 7 lots, at £104 2s. 6d.; 22 lots, at £104; 5 lots, at £103 17s. 6d.; 74 lots, at £103 15s.; and 78 lots, at £103 10s. The total sum realized was £20,746 5s.——On the previous day, £50,000 of stock in the *Newcastle and Gateshead Water Company* was sold at prices ranging from £146 to £150. At a sale by auction at Eckington last Wednesday, a number of original shares of £1 each in the *Eckington and Mosbro' Gas Company* realized from £1 14s. to £1 15s. apiece; and 10 additional £5 shares produced £7 6s. each.——Last Wednesday, Mr. Hodgkinson sold in the town a number of shares in the *Matlock Water Company* and the *Matlock Gas Company*. Thirty-seven £10 fully paid-up shares in the former realized from £13 2s. 6d. to £13 10s.; and 65 fully paid-up £5 shares sold from £5 12s. 6d. to £5 17s. each. Fourteen £10 paid-up shares in the Gas Company produced £19 and £19 10s.

The London County Council (Subways) Bill.—The Select Committee of the House of Lords engaged in considering the provisions of the London County Council (Subways) Bill last Wednesday had before them clause 11, which deals with the regulation of water, gas, and electric wire mains carried through the subway. The six Electric Lighting Companies petitioned against the Bill; objecting to have their wires subject to the control of the County Council instead of the Board of Trade, and claiming to remain, as hitherto, under the general order of 1889. The Earl of Crawford was examined in support of the petitioners' case. He stated that the objection to having the mains for electric lighting and gas and water in one chamber was the danger of flooding and of explosion from fire when the pipes were under repair. It would, in his opinion, be desirable that the Board of Trade should have control of the mains in the subways, and not the County Council. The expense of insulating conductors required for carrying the wires through subways would be very great, and the inconvenience in breaking up streets to make lateral connections would be another objection. Sir F. Bramwell also gave evidence in support of the objections raised. The Committee decided that the petitioners had proved their case, and that they should be exempted from the provisions of the Bill, with the exception that if clause 11 were so altered that the Board of Trade should be the controlling authority, the Companies should not be exempt.

Burgess Hill Water Company.—From an available balance of £813, the shareholders of this Company, at their recent half-yearly meeting, declared a dividend at the rate of 3½ per cent., free of income-tax.

Gas Explosion at Wigan.—Yesterday week a serious gas explosion took place in an empty house at Wigan. The landlord (Mr. W. Ormston), with his wife and daughter, entered for some purpose or other; and on stepping into one of the front rooms with a lighted candle, a loud explosion occurred. They were badly burnt about the head and face, whilst the house was also considerably damaged. Mr. and Mrs. Ormston's injuries were of such a nature that they had to be medically attended. On an examination of the premises being made, it was found that a gas-burner in the room where the accident happened had been left turned on.

The Finances of the Stoke-upon-Trent Gas Department.—At the monthly meeting of the Stoke Town Council last Thursday week, Mr. Sant moved, in accordance with notice, "That the report given to the Gas Committee and the Town Council by Messrs. A. Lass, Wood, and Co., in respect to the gas-works accounts is incorrect—(1) As to the sinking fund; (2) as to the cost price of production of gas at the works; (3) as to the formation of a reserve fund." He said the Council knew perfectly well that the figures given in the report were not in accordance with the facts. He did not say that Mr. Lass had made a mistake in his calculations, but simply that he was not furnished with the full materials. For instance, Mr. Lass was not informed of a sum of £1600, which was repaid into the sinking fund, and which, instead of being short by £1000, was overpaid by £200. Mr. Sandland seconded the motion, for the purpose of discussion. Mr. Bennett moved, and Alderman Leason seconded, as an amendment, that the Council accept the report in its entirety. The amendment was carried by a large majority. Mr. Geen moved, as a further amendment, that the report was incorrect, because it omitted mention of the £1600, that it was inaccurate in dealing with the cost of gas, and that the question of the reserve fund should be referred to the Local Government Board. Mr. Marks seconded the amendment, which the Mayor ruled out of order, as in his opinion it was a direct negative, and could not therefore be put.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1009.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apr.	10½	Alliance & Dublin 10 p. c.	10	16¼—17½	..	6 0 0
100,000	10	"	7½	Do. 7 p. c	10	11—12	..	6 5 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 5
100,000	20	27 May	8	Bahia, Limited	20	10—12*	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6¼—6¾	..	5 11 1
40,000	5	"	7½	Do. New	4	4¾—5	..	6 0 0
380,000	Stck.	26 Feb.	12½	Brentford Consolidated	100	212—217	+2	5 12 11
150,000	"	"	9½	Do. New	100	162—167	..	5 10 9
220,000	20	11 Mar.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
888,500	Stck.	11 Mar.	5	Bristol	100	95—100	..	5 0 0
320,000	20	13 Apr.	11½	British	20	42—44	..	5 2 3
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	"	8½	Do. 7 p. c.	10	15—16	+½	5 6 3
328,750	10		—	Buenos Ayres (New) Limited	10	7—8	+½	—
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	94—97	..	6 3 9
150,000	20	26 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	13 Apr.	13	Commercial, Old Stock	100	229—234	..	5 11 1
165,000	"	"	10	Do. New do.	100	180—190	..	5 5 3
130,000	"	30 Dec.	4½	Do. 4½ p. c. Deb. do.	100	118—123	..	3 13 2
800,000	Stck.	30 Dec.	13	Continental Union, Limited	100	220—225	..	5 15 6
200,000	"	"	10	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	30 Mar.	10	Crystal Palace District	100	185—195	..	5 2 7
486,090	10	29 Jan.	10	European, Limited	10	19—20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	13¾—14½	..	5 3 11
5,470,820	Stck.	12 Feb.	12	Gaslight & Coke, A, Ordinary	100	207—211	−3	5 13 9
100,000	"	"	4	Do. B, 4 p. c. max.	100	94—98	−2	4 1 7
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	248—253	+1	3 19 1
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	116—121	..	4 2 9
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	169—174	..	4 6 2
1,300,000	"	"	7	Do. H, 7 p. c. max	100	154—158	+1½	4 8 7
463,000	"	"	10	Do. I, 10 p. c. Prf.	100	245—250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	146—150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	113—117	+½	3 8 5
894,850	"	"	4½	Do. 4½ p. c. do.	100	118—123	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	163—169	..	3 11 0
3,800,000	Stck.	12 May	12	Imperial Continental	100	215—219	−2	5 9 7
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4—4½	..	6 13 4
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	108—110	..	4 10 11
541,920	20	27 Nov.	6½	Monte Video, Limited	20	14¼—15¾	..	8 7 8
150,000	5	27 May	10	Oriental, Limited	5	7¼—8¼	..	6 1 2
60,000	5	30 Mar.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2—3	..	—
				People's Gas of Chicago—				
420,000	100	3 May	6	1st Mtg. Bds.	100	104—107	+2	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	103—106	..	5 13 2
150,000	10	15 Oct.	10	San Paulo, Limited	10	8—9	..	—
500,000	Stck.	26 Feb.	15½	South Metropolitan, A Stock	100	270—275	−5	5 12 9
1,350,000	"	"	12	Do. B do.	100	218—222	−2	5 8 1
200,000	"	"	13	Do. C do.	100	235—240	..	5 8 4
725,000	"	30 Dec.	5	Do. 5 p. c. Deb. Stk.	100	142—146	..	3 8 6
60,000	Stck.	11 Mar.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
729,331	Stck.	30 Dec.	10	Chelsea, Ordinary	100	252—257	..	3 17 9
1,720,252	Stck.	13 Apr.	8	East London, Ordinary	100	197—202	+1	3 19 2
544,440	"	30 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	136—140	..	3 4 3
700,000	50	11 Dec.	8½†	Grand Junction	50	98—102	..	4 3 4
708,000	Stck.	12 Feb.	10½	Kent	100	260—265	+2½	3 19 3
1,043,800	100	30 Dec.	9½	Lambeth, 10 p. c. max.	100	220—225	..	4 4 5
406,200	100	"	7½	Do. 7½ p. c. max.	100	187—192	..	3 18 1
279,700	Stck.	30 Mar.	4	Do. 4 p. c. Deb. Stk.	100	120—123	..	3 5 0
500,000	100	12 Feb.	12½	New River, New Shares	100	325—335	..	3 12 4
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk	100	126—129	..	3 2 0
902,300	Stck.	30 Dec.	6½	S'thwk & V'xhall, 10 p. c. max.	100	148—153	+3	4 4 11
126,500	100	"	6½	Do. D 7½ p. c. do.	100	133—138	..	4 14 3
1,155,066	Stck.	11 Dec.	10	West Middlesex	100	242—246	−1	4 1 3

*Ex div.

† Next dividend will be at this rate.

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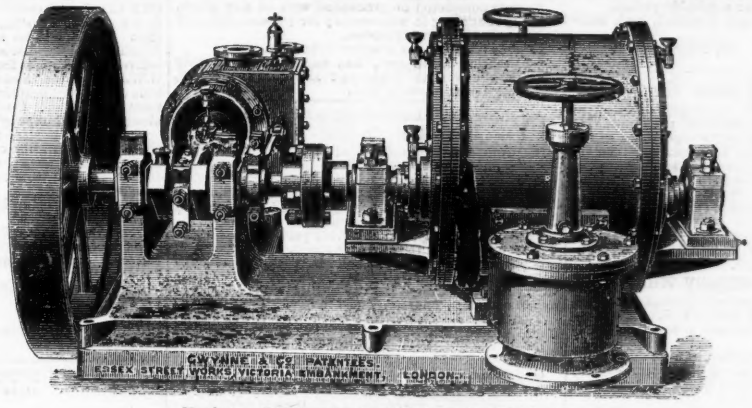

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JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, or NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

OXIDE OF IRON FOR GAS PURIFICATION.

JAMES GORDON & Co., Brokers, can offer Cargoes of good quality; also 2500 tons of SPENT OXIDE.
Samples and price on application.
Address Borough Buildings, 7, Rumford Street, LIVERPOOL.

LIQUOR and Tar wanted.
BROTHERTON AND Co., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

LIQUID FUEL.

TAR Oils, Naphthalene, Oil Residues, Tar, Petroleum, &c. SADLER'S PATENT BURNER is the simplest and most effective. No smoke; no Ashes.
For particulars and price of Burner and Cheap Oils, apply to SADLER AND Co., LIMITED, MIDDLESBROUGH.

A YOUNG MAN (Italian), aged 22, who has served his time with an Engineering Firm in England, and possesses a Certificate for Civil Engineering from the Glasgow University, desires an engagement in a Gas or Water Works, or Engineering Establishment, in the Colonies or South America. Good Draughtsman, thorough knowledge of English, Italian, and French.
Address INFANTE, 50, Woburn Place, Russell Square, LONDON.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 1037 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 70, Wellington Street, GLASGOW; 58, Fountain Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

MR. J. C. CHAPMAN, Fellow of the Chartered Institute of Patent Agents, advises on all matters connected with LETTERS PATENT FOR INVENTIONS and the PROTECTION OF TRADE MARKS, &c., at home and abroad. Preliminary Information and Handbook on application.
70, Chancery Lane, LONDON, W.C.

WANTED, by an Undertaking in Derbyshire, a GAS AND WATER RENTAL CLERK. Wages £2 per week.
Also a GAS AND WATER METER INSPECTOR, willing to make himself generally useful. One with a knowledge of Plumbing preferred. Wages, 30s. per week.
Applications, in applicant's own handwriting, to be sent to the undersigned, stating age and qualifications, accompanied by not more than two testimonials of recent date; and none need apply whose antecedents will not bear the strictest investigation.
C. E. JONES,
Consulting Engineer.
Chesterfield, May 25, 1892.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

OLPHERT'S OXIDE.

FINEST Quality of Natural Bog Ore Apply for particulars to the Sole Agent, Mr. THOS. L. ARCHER, Cathedral Chambers, Half Street, MANCHESTER.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

OIL for the "Wells" or "Lucigen" Lamps.
HARDMAN AND Co., Miles Platting, MANCHESTER.

COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. See Advertisement p. IV., centre of JOURNAL.
Inquiries should be addressed to THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

DRAWINGS, Tracings, Specifications, Quantities, &c., prepared by an experienced Engineering Draughtsman. Plans of Works made, copied, or enlarged. Blue copies made. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address J. L. FEATHERSTONE, 173, Fentiman Road, LONDON, S.W.

FRIEDRICH LUX, Ludwigshafen am Rhein; and at No. 142, Great Portland Street, London, W.
LUX'S Gas Regulators for every consumption.
LUX'S single-stem Pressure-Gauges.
LUX'S Regulator for Gas-Engines.
LUX'S Gas-Balance.
LUX'S new Gas Regulator for Inverted Lamps and other Apparatus for Gas Lighting, &c.

CARBON.

THE Bute Docks Company have for DISPOSAL from 8 to 10 tons of good clean RETORT CARBON.
Apply to S. WARD, Manager, Bute Gas-Works, CARDIFF.

WANTED, at Ramsgate, a thoroughly good RETORT SETTER. Preference will be given to one understanding the Setting of Retorts fired by Gaseous Fuel. Constant employment to a steady man.
Application, in the first case, to be made by letter, stating Age, Experience, and References, to
WILLIAM A. VALON,
Engineer.
140 and 141, Temple Chambers, Temple Avenue, London, E.C.

GAS-FITTER and Bellhanger wanted.
Apply to W. Batchelor, 35, Warwick Street, Leamington.

CHIPPING NORTON GAS COMPANY.

WANTED, at once, a Handy Man, capable of laying Mains and Services, fixing Meters, &c. A permanency for a suitable person.
Apply, stating age and wages required, with testimonials, to
T. Burtonshaw,
Manager.

WANTED, for a large Gas-Works, an experienced and thoroughly competent ASSISTANT. Age about 30; married preferred. He must be capable of taking the entire supervision of the Works in the absence of the Engineer or Foreman. Must be a strictly temperate man, and good Draughtsman, and understand the Testing of Gas for Impurities.
Wages to commence, £3 per week.
Apply, by letter, to No. 2102, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

SUPERINTENDENT AND MANAGER OF GAS-WORKS.

THE Rugby Gas Company will, about Michaelmas next, or earlier (if arranged), require a SUPERINTENDENT and MANAGER of their Gas Manufactory Works and Business connected therewith.
Salary £200 per annum, with House, Fuel and Light, and Rates and Taxes free. About 10,000 tons of Coal carbonized. Population about 13,000. Guarantee required.
Applications, in own writing, stating age and, fully and concisely, particulars of experience and employments, with three recent testimonials only, and date (approximately) when duties could be entered upon, to be sent, marked "Application," to the undersigned, on or before June 14.
T. M. Wratislaw,
Rugby. Secretary.

SECOND-HAND Cast-Iron Tank wanted at once, about 38 ft. to 40 ft. diameter, and 10 ft. or 12 ft. deep. Must be in good condition.
Price (delivered on rail), with full particulars, to S. Bark, Gas-Works, Goldalming.

FOR SALE—From 150 to 180 tons of SPENT OXIDE.
Apply to the Manager, Gas-Works, Stretford, near Manchester.

FOR SALE—About 55 tons of new CAST-IRON WATER-PIPES, salved from the *Yorkshire Lass*, measuring 8 inches diameter, and 9 feet long; also a few PIPES of a larger size now lying at Portsmouth.
Send price per ton to Alfred Gann and Co., 2, Fowkes-Buildings, Gt. Tower Street, London.

GASHOLDER AND CONDENSERS FOR SALE.

THE Great Yarmouth Gas Company have FOR DISPOSAL a GASHOLDER, with Cast-Iron Tank complete; also a set of CONDENSERS in good condition.
Further particulars can be obtained on application to the Engineer.

GAS-METERS FOR SALE.

THE Royal Agricultural Hall Company, Limited, Islington, have FOR SALE one 500-LIGHT DRY METER, and one 200-LIGHT DRY METER, which until recently have been used at the Hall, and are in good working order.
Apply to R. Venner, Secretary, Royal Agricultural Hall Company, Limited, Islington.

FOR SALE, perfectly new—One 20,000 feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valve, Inlet and Outlet Disc Valves, and Connections. Also one EXHAUSTER, as above, capable of passing 7500 cubic feet per hour, with Fittings as above. Also, a number of 2-inch, 3-inch, 4-inch, 6-inch, 8-inch, 12-inch, and 18-inch double-flanged RACK-VALVES.
Address No. 2104, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

TO GAS COMPANIES AND CORPORATIONS.

THE Dundee Gas Commissioners have FOR SALE two GAS EXHAUSTERS, each capable of passing 50,000 cubic feet per hour.
The Exhausters, which are in excellent condition, are known as Laidlaw's Rotary, and delivery can be given at once.
Price £60 each, free on Rail in Dundee.
John M'Crae,
May 25, 1892. Engineer.

BOROUGH OF DEWSBURY.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery at their Gas-Works, Savile Town, near Dewsbury, of the following quantities of GAS COAL during a period of One, or of Two, or of Three years, commencing on the 1st day of July next:—

First year . . .	17,000 tons.
Second year . .	18,000 „
Third year . .	19,000 „

Tenders must specify prices for delivery by Road, or by Water, or by Rail, and be made on Forms to be had on application to Mr. Chas. A. Craven, Engineer and Manager, Savile Town Gas-Works, Dewsbury, from whom any further information can be obtained.
Sealed tenders, endorsed "Tender for Gas Coal," to be sent to E. Mawdesley, Town Clerk, Dewsbury, not later than Saturday, the 11th day of June next.
The Corporation do not bind themselves to accept he lowest or any tender.
By order,
E. Mawdesley,
Town Clerk.
Town Clerk's Office, Town Hall,
Dewsbury, May 27, 1892.

MESSRS. Wheatley and Mackenzie beg to say that they have acquired the business of the late **W. H. BENNETT, Esq.**, and that having a special experience in matters connected with Gas, Water, and Sanitary Improvement, will continue to give the same assistance to Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, or LETTERS PATENT.
Patents completed or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.
Patents procured for Foreign Countries.
Information as to cost, &c., supplied gratuitously upon application to Wheatley and Mackenzie, 40, Chancery Lane, London, W.C.

AMMONIACAL LIQUOR AND SURPLUS TAR.

THE Directors of the Barnsley Gas Company are desirous of receiving TENDERS for the purchase of the whole of the AMMONIACAL LIQUOR, and for the surplus COAL TAR, produced at their Works at Pontefract Road and Old Mill, for a period of One, Two, or Three years, as may be agreed upon, commencing from July 1 next.
Probable quantity, and any other particulars, may be had on application to the undersigned.
Separate tenders, sealed, and endorsed "Tender for Ammoniacal Liquor" or "Surplus Coal Tar," as the case may be, addressed to the Chairman, to be sent to me on or before Thursday, the 9th day of June, 1892.
The Directors do not bind themselves to accept the highest or any other tender.
By order,
John Hutchinson, Manager.
Gas Office, Barnsley, May 25, 1892.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the supply of WROUGHT-IRON TUBES and FITTINGS.
Forms of Tender may be obtained on application to Mr. Thomas Holgate, Gas-Works Manager, Halifax.
Tenders, endorsed "Tender for Tubes, &c.," must be sent to the undersigned on or before the 9th of June, 1892.
The tender of any person paying less than the minimum standard rate of wages, and who does not observe the hours and conditions of labour generally recognized in the district, will not be accepted. This condition shall be construed to the acts of Sub-Contractors, where such may exist.
The Committee do not bind themselves to accept the lowest or any tender.
By order,
Keighley Walton,
Town Clerk.

COUNTY BOROUGH OF HALIFAX.

TO MANUFACTURING CHEMISTS AND TAR DISTILLERS.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the purchase of the surplus TAR produced at their Gas-Works during the year ending the 30th of June, 1893.
Delivery may take place from the Railway Siding of the Corporation Gas-Works or from the Canal Wharf of the Calder and Navigation Company, with which a Pipe communicates.
Full particulars may be obtained on application to the Engineer, Mr. Thomas Holgate, F.C.S., Gas-Works, Halifax.
Sealed tenders, endorsed "Tar," stating the price offered per ton, and the mode of removal, to be sent to the undersigned not later than Ten a.m., on Friday, the 10th of June, 1892.
The highest or any tender not necessarily accepted.
By order,
Keighley Walton,
Town Clerk.
Town Hall, Halifax,
May 28, 1892.

CORPORATION OF NOTTINGHAM.
(Gas Department.)

TENDERS FOR COALS.

THE Gas Committee are desirous to receive OFFERS for supplies of COALS, COBBLES, or NUTS for the period terminating the 30th of June, 1893.
The Large Coals and the Cobbles or Nuts are to be separately delivered, where and as from time to time directed, by and at the expense of the Contractors, upon the Gas-Works Siding, Great Northern Railway, in the East Croft at Nottingham, and also on the Gas-Works Sidings, Midland Railway, at Radford and Basford respectively; and at and after the rate of one-eighth part of such total quantity in each calendar month, commencing with the month of July next, till the Corporation shall be satisfied with the amount of accumulated Stock, and afterwards at such rate as shall be from time to time directed, till the agreed quantity shall have been delivered.
The Coals, Cobbles, or Nuts are to be the best of their respective kinds, freshly wrought and well screened (description, sizes, and inclination of screen to be specified), to be as free as possible from Sulphur, Bats, Bind, Refuse, and Dirt, and shall be weighed (20 cwt. to the ton), upon the Corporation machines, or upon such other machines as may be mutually agreed upon.
Payments will be made monthly, if and so long as the contract shall be duly fulfilled.
The Corporation do not bind themselves to accept the lowest or any tender.
Further Information and Forms on which the tenders must be made may be obtained on application to me, at the General Manager's Office; and the tenders (sealed) specifying the description of Coals, the Seam, and the Pits at which they are to be raised, and stating the prices for deliveries at the several places, and in manner and subject to the conditions aforesaid, must be delivered to Samuel George Johnson, Esq., Town Clerk, on or before Saturday, the 4th day of June, 1892.
By order,
William Reginald Chester,
Engineer and General Manager.
Corporation Gas Offices, George Street,
Nottingham, May 26, 1892.

UXBRIDGE & HILLINGDON GAS CONSUMERS COMPANY.

GAS COAL.

THE Directors of the above Company invite TENDERS for the supply of 4000 tons of GAS COAL, deliveries of which are to commence the first week of July, 1892, and finish the last week in May, 1893. Tenders to be made out for 2000 tons of best South Yorkshire unscreened SILKSTONE GAS COAL, delivered in Trucks free at Uxbridge Railway Station, G.W.R., each ton to contain 21 cwt. to the ton, and 2000 tons of the best description of unscreened GAS COAL from the Durham Coal-Fields, delivered by barge free alongside the Company's Works, Grand Junction Canal.
Tenders are to state the names of the Pits from which the above description of Coal will be supplied, the same to be fresh wrought, and free from Slate and other Impurities, and to the entire satisfaction of the Company's Engineer.
Deliveries to be made according to the requirements of the Company.
Tenders to be received on or before the 11th day of June next, addressed to the Chairman, Gas Company's Offices, Uxbridge, Middlesex, and endorsed "Tender for Coal."
A form of tender will be sent on application.
W. & W. M. Gardiner,
Secretaries.
Uxbridge, Middlesex,
May 25, 1892.

COUNTY BOROUGH OF STOCKPORT.
(Gas Department.)

TO CONTRACTORS, BUILDERS, AND OTHERS.

THE Gas Committee are prepared to receive TENDERS for the erection (on foundations already in) of Retort-House Extension at their Portwood Works.
Quantities may be obtained, and Drawings and Specifications seen, on and after the 27th of May next, on application to the Engineer, Mr. S. Meunier, Stockport.
Intending Contractors will be required to deposit the sum of £2, which will be returned on receipt of a *bonâ fide* tender.
No Form of Tender other than that issued by the Committee will be entertained.
Tenders, endorsed "Tender for Retort-House Extension," and addressed to the Chairman of the Gas Committee, to be sent in not later than Ten a.m. of Wednesday, the 8th of June next.
The resolution of the Council that Contractors will be expected to pay the average rate of Wages paid in the district will apply to this Contract.
The Committee do not bind themselves to accept the lowest or any tender.
By order,
Walter Hyde,
Town Clerk.
Stockport, May 23, 1892.

ELLAND-CUM-GREETLAND GAS COMPANY.

ISSUE OF 500 NEW 4½ PER CENT. PREFERENCE SHARES OF £10 EACH.

THE Elland-cum-Greetland Gas Company offer FOR SALE BY TENDER, pursuant to the provisions of the Elland Gas Order, 1878, on the 17th day of June, 1892, in lots of Ten Shares each, 500 NEW PREFERENCE SHARES of £10 each, bearing a fixed Preferential Dividend of 4½ per cent. per annum, contingent upon and payable out of the profits of each year. A deposit of 10 per cent. upon the purchase-money will be payable within a week after the acceptance of any tender; and the balance of purchase-money will be payable at the end of Two calendar months from the date of such acceptance.
Any Premiums on this issue will not be considered profits, but will be expended in extending or improving the Works, or in paying off borrowed Money.
The Company was incorporated by the Elland Gas Act, 1861, with an authorized Capital of £35,000. Such Capital now consists of 609 £2 per cent. Preference Shares of £10 each; 300 £5 per cent. Preference Shares of £10 each; and 2501 Ordinary Shares of £10 each, the standard rate of Dividend upon which is 10 per cent. per annum. By the Elland Gas Order, 1878, the Company was authorized to raise the Additional Share Capital of £25,000. Of this amount £5263 15s. has been raised by the issue of 500 like Shares to those now offered.
The maximum rates of Dividend upon the Ordinary Shares have been paid since the Act of 1861 down to the date of the Gas Order, and since that time have been increased, now amounting to 12 per cent. With gas at its present price, the Company is authorized to pay a Dividend on its Ordinary Shares of 14 per cent.
The Company have raised loan Capital amounting to £11,750, and have a Reserve Fund amounting to £6750, and an Insurance Fund amounting to £2000. These funds greatly exceed the average amounts of similar funds formed by Gas Companies with the same amount of Capital. The new Capital is required to extend the Company's Works.
The Shares now offered rank after the existing Preference Capital amounting to £9990, created under the Act of 1861, and equally with the 500 New Preference Shares already issued; and all New Preference Shares to be issued under the Order of 1878, but in priority to the Ordinary Shares, will be entitled to Dividend on and after the 1st of September next.
The Acts of Parliament of the Company, and their published statements of account, may be inspected, and copies of these particulars and conditions of sale and any further information may be obtained on application to Mr. Robert Porter, Engineer and Secretary of the Company, Gas-Works, Elland, Yorks, or to the undersigned Solicitors of the Company.
Sealed Tenders for lots of ten shares each, to be forwarded to the Secretary, not later than the 16th of June next. The Sale will be subject to a reserved price per lot, notice of which will be sent to the Board of Trade before the Tenders are opened.
Lancaster and Wright,
Solicitors.
10, Piccadilly, Bradford,
May 9, 1892.

WIRE ROPE & GASHOLDERS.

It is well known that some alterations we designed and carried out for the Manchester Corporation in 1889 have been the subject of an Action for Infringement of Patent Rights.

The Plaintiffs have failed to uphold their contention; the Court deciding **that the use of Ropes did not come within the scope of their claim.**

The design carried out at Manchester was in accordance with a Patent granted to Mr. E. L. Pease; and that the new method of preserving the true level of a Gasholder with Ropes, instead of Columns, is a success, may be gathered from the fact that **the Gasholder at Manchester has worked since 1889 without a moment's attention.**

That Wire Ropes are admirably adapted for use in connection with Gasholders, will be seen by the following considerations.

1. Their use means a great saving, combined with absolute security.
2. The method of working and the nature of the fittings are the simplest possible.
3. Every part is readily accessible.
4. Renders possible the use of very shallow Holders.
5. As all the moving parts act independently, there is no danger in an accident to any one of them.
6. No alteration needed in the construction of the Holder or Tank.
7. Applicable to the Inner Lift alone, or to all Lifts of a multiple lift Holder.
8. Very useful in conjunction with Columns to secure the true working of old Holders.

The large number of Holders working on this system in America and England, and giving complete satisfaction, proves its reliability.

Wire Ropes, when used in conjunction with existing Columns, render it possible to **increase storeage** by means of added Lifts, even when a Holder works badly, because, owing to the way in which the Rope is arranged, it is impossible for any lift of the Holder to get out of level.

We shall be very pleased to supply Drawings and Estimates to meet all requirements.

ASHMORE, BENSON, PEASE, & Co., Limited,

STOCKTON-ON-TEES.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

TENDERS FOR GAS COAL.

THE Directors of the Sligo Gaslight and Coke Company are prepared to receive TENDERS for the supply of 2000 tons of screened GAS COAL, delivered over Twelve months in lots of 300 to 400 tons as required. Quote c.i.f. and f.o.b.

Terms, cash at one month after delivery.

Tenders, endorsed "Tender for Coal," to be addressed to the Chairman, not later than June 21 next.

The Directors do not bind themselves to accept the lowest or any tender.

C. B. TULLY,
Secretary and Manager.

Gas-Works, Sligo,
May 25, 1892.

SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gas-light Company invite TENDERS for the supply of about 13,000 tons of screened GAS COALS, and about 1000 tons of good English CANNEL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the year commencing July 1, 1892, and ending June 30, 1893.

The Directors reserve to themselves the right to divide the quantity into two or more Contracts, and do not bind themselves to accept the lowest or any tender.

Tenders must be made on Forms (containing further particulars), which may be obtained on application at the Company's Works, or by post, and must be sent to the undersigned, on or before the 17th day of June, 1892.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 18, 1892.

SHREWSBURY GASLIGHT COMPANY.

DISPOSAL OF SURPLUS TAR.

THE Directors of the above Company are desirous of receiving TENDERS for the purchase of the surplus TAR made at their Works during the year commencing July 1, 1892.

The estimated quantity for disposal is about 950 tons per annum.

Tenders must be made on Forms (containing further particulars), which may be obtained on application at the Company's Works, or by post, and must be sent in to the undersigned not later than the 17th day of June, 1892.

The Directors do not bind themselves to accept the highest or any tender.

By order,
WM. BELTON, Assoc.M.Inst.C.E.,
Secretary and Manager.

Gas-Works, Shrewsbury,
May 18, 1892.

COUNTY BOROUGH OF HUDDERSFIELD.

(GAS DEPARTMENT.)

CONDENSER.

THE Gas Committee are prepared to receive TENDERS for the construction of a WROUGHT-IRON TUBULAR WATER CONDENSER, to be erected in an existing overhead Tank, at the Leeds Road Works.

Full Particulars and Specifications may be had upon application to the Engineer, and Drawings inspected at his Office.

Tenders to be addressed and delivered to Mr. W. R. Herring, Engineer and Manager, Gas-Works, Leeds Road, on or before Wednesday, the 15th of June next, endorsed "Tender for Condenser."

By order,
H. BARBER,
Town Clerk.

Town Hall, Huddersfield,
May 23, 1892.

BOROUGH OF MACCLESFIELD.

THE Gas Committee are prepared to receive TENDERS for the supply of the undermentioned MATERIALS and CARTING required during a period of Twelve months, commencing the 1st of July, 1892.

1st.—The best hand-picked BUXTON LIME, delivered fresh at Macclesfield, free from Dirt and Ashes, in such quantities as may be ordered.

2nd.—Wrought-Iron Lap-Welded STEAM-TUBES and FITTINGS.

3rd.—Cast-Iron MAINS and IRREGULARS.

4th.—OILS, PAINT, and DRUGGIST SUNDRIES.

5th.—CARTING—

(*a*) Contractors to state price per ton over the Gas Committee's Weighing-Machine from the Railway Companies' Yards and Canal Wharf, Buxton Road.

(*b*) Contractors to provide own Fillers, Horses, Carts, Shovels, Props, and all Implements; also to arrange with the Railway Companies as to Wagons being placed in position and standing under load, and be answerable for all demurrage.

(*c*) The particulars of the Wagons containing the Materials to be emptied, and any other Materials that require to be carted, will be furnished to the Contractor at the Gas Office each morning at Eight o'clock.

Any further information required can be obtained on application to Mr. Ford, Engineer, Gas-Works.

Sealed tenders, properly endorsed, to be addressed to the Chairman, Gas Committee, Town Hall, Macclesfield, and to be sent in not later than Saturday, the 11th of June, 1892.

The Committee do not bind themselves to accept the lowest or any tender.

(Signed) W. FREDK. TAYLOR,
Town Clerk.

May 9, 1892.

GLASGOW CORPORATION GAS.

THE Gas Committee of the Glasgow Corporation invite TENDERS for the supply of such METERS (Dry and Wet) as they may require for Twelve Months, from the 1st of June, 1892.

Forms of tender may be had on application to the Manager, at the Gas Office, 45, John Street, Glasgow, and sealed offers, marked "Tender of Meters," to be addressed to, and lodged with, the subscriber on or before Saturday, the 4th prox.

The Committee do not bind themselves to accept the lowest or any offer.

J. D. MARWICK,
Town Clerk.

City Chambers, George Square,
Glasgow, May 26, 1892.

YORKTOWN AND BLACKW TER GAS AND COKE COMPANY, LIMITED.

TENDERS are invited for the supply of about 800 tons, more or less, of really good GAS COAL; to be delivered at the Blackwater Station, S.E.R., carriage paid, between the 1st of July, 1892, and the 1st of July, 1893, in quantities of about 60 tons, as ordered by the Secretary, giving fourteen days' notice before expected at the Station.

Terms, payments monthly.

Sealed tenders, addressed "Tender for Coals," and forwarded to the Secretary, on or before the 6th of June, will be placed before the Directors at a meeting immediately after.

Gas-Works, Yorktown,
May 25, 1892.

TAMWORTH GASLIGHT AND COKE COMPANY.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Directors of the above Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR, produced at their Works during a period of Two years commencing from June 24, 1892.

Tenders must be sent to the Chairman of the Company, 23, George Street, Tamworth, on or before Monday, June 20 next.

WILLIAM ARNOLD,
Secretary.

Gas-Works, Tamworth,
May 27, 1892.

PETERBOROUGH GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company invite TENDERS for the supply of best screened GAS COAL and NUTS, for One Year, commencing the 1st of July next.

Form of Tender and Conditions may be obtained on application to the undersigned.

Tenders to be sent in by the 14th of June, 1892, endorsed "Coal," and addressed to the Chairman of the Company.

The Directors do not bind themselves to accept the lowest or any tender.

JOHN BARTON,
Secretary and Manager.

Gas-Works, New Road,
Peterborough, May 28, 1892.

TENDERS FOR GAS COAL.

THE Directors of the Victoria New-market Gaslight and Coke Company, Limited, invite TENDERS for the supply of 4500 tons of best screened GAS COAL during the ensuing Twelve months, ending June 30, 1893.

Tenders, stating price per ton, delivered free at Newmarket Station as required, to be sent on or before June 11, 1892, to the undersigned, from whom any further particulars may be obtained.

The Directors do not bind themselves to accept the lowest or any tender.

By order,
J. H. TROUGHTON,
Manager and Secretary.

Gas-Works, Newmarket,
May 28, 1892.

CITY OF BIRMINGHAM.

TENDERS FOR AMMONIACAL LIQUOR.

THE Gas Committee invite Tenders for the purchase of the AMMONIACAL LIQUOR produced at their Works during a period of Ten years beginning on July 1, 1893.

The quantity produced in the year ended March 31 1891, was 13,682,000 gallons of 10-oz. Liquor.

Provision may be made for dealing with the Liquor either in Works now erected on Land belonging to the Corporation, or on Land to be let for the erection of new Works.

Copies of the conditions on which tenders are invited may be obtained on application to

EDWIN SMITH,
Secretary.

City Gas Offices, Council House,
Birmingham.

COUNTY BOROUGH OF ST. HELENS.

GAS COALS.

THE Gas Committee of the Corporation invite TENDERS for the supply at their Works of COAL and CANNEL for Gas-Making purposes for One year and for Two years, to commence the 1st of July, 1892.

Forms of Tender with all particulars may be obtained on application to Mr. Samuel Glover, Gas Engineer, St. Helens.

Tenders on such forms, addressed to the Chairman of the Gas Committee, Warrington Old Road, St. Helens, and endorsed "Coal" or "Cannel," as the case may be, must be delivered by the 7th of June next.

The Committee do not bind themselves to accept the lowest or any tender.

WM. JNO. JEEVES,
Town Clerk.

Town Hall, St. Helens,
May 20, 1892.

ACCRINGTON GAS AND WATER WORKS COMPANY.

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Directors invite Tenders for the purchase of the TAR and AMMONIACAL LIQUOR which may be produced at their Accrington and Great Harwood Works during a period of One year, commencing on the 1st of July next.

The quantity will be about 1300 tons of Tar and 3000 tons of Liquor (10-oz.).

Tenders, addressed to the Chairman, Offices of the Company, St. James's Street, Accrington, must be in my hands not later than Wednesday, the 8th of June.

By order,
CHAS. HARRISON,
Secretary and Manager.

CORPORATION OF LANCASTER.

(GAS DEPARTMENT.)

TENDERS FOR GAS COAL AND CANNEL.

THE Gas Committee are prepared to receive TENDERS for the supply of about 11,000 tons of GAS COAL and 5000 tons CANNEL per annum, delivered on the Gas-Works Siding, Lancaster, in such quantities and at such times as may be required during a period of One, Two, Three, or Five years, commencing delivery Aug. 1 next.

Sealed tenders, endorsed "Gas Coal," giving full particulars of the Coal offered, must be sent to Thom. Swainson, Esq., Town Clerk, Lancaster, on or before the 20th day of June next.

Forms of Tender may be obtained on application to the undersigned.

The lowest or any tender not necessarily accepted.

C. ARMITAGE,
Manager.

Gas-Works, Lancaster,
May 27, 1892.

BROMLEY GAS CONSUMERS' COMPANY.

ADDITIONAL CAPITAL.

MINIMUM PRICE £15 2s. 6d. PER SHARE.

NOTICE is hereby given, that under the powers conferred by the Bromley Gas Act, 1879, the Directors are prepared to receive TENDERS for the purchase of 400 ORDINARY SHARES, of the nominal value of £10 each, in lots not being less than five of such Shares, and at prices not being less than the minimum of £15 2s. 6d. per Share.

The Dividend for the last Twelve months on this class of Shares has been 8½ per cent.

The Shares tendered for will be entitled to a standard Dividend not exceeding 7 per cent., subject to variation in accordance with a Sliding Scale, as in the said Act is provided.

Conditions of Sale and Forms of Tender may be obtained upon application to the Secretary of the Company, at the Works, Bromley, Kent, or of Messrs. Willett and Latter, Market Square, Bromley, Kent.

Tenders must be sent in not later than Thursday, the 23rd day of June, 1892, at Three o'clock p.m., addressed to the undersigned, at the Company's Works, Bromley, Kent.

HENRY W. AMOS, Secretary.

Bromley, Kent, May 21, 1892.

EIGHTH EDITION, REVISED AND ENLARGED.

Just published, Fcap. 8vo, 5s. 6d. Cloth Limp, or 6s. Cloth Boards.

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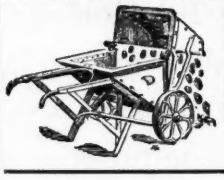

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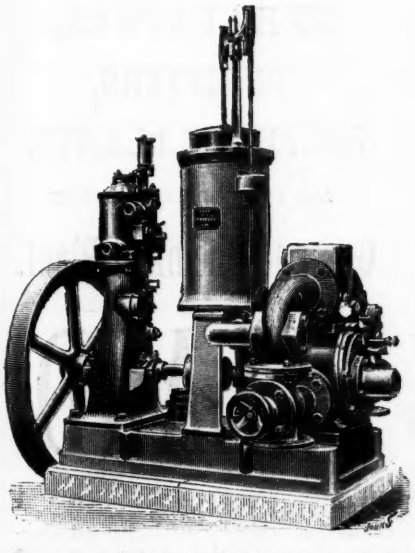

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Illuminating Power	38·22 candles.
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Yield of Gas per ton	10,500 cub. ft.
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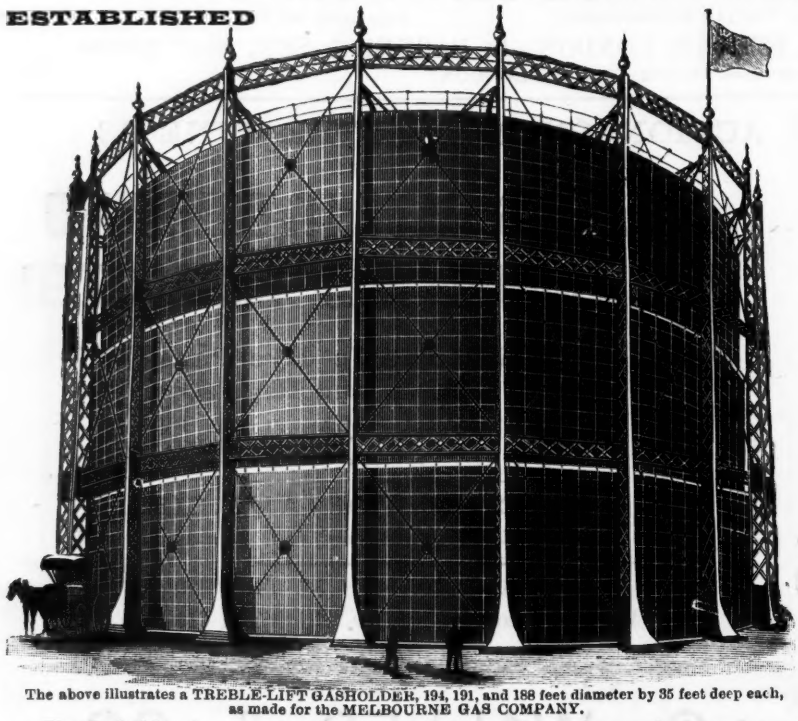

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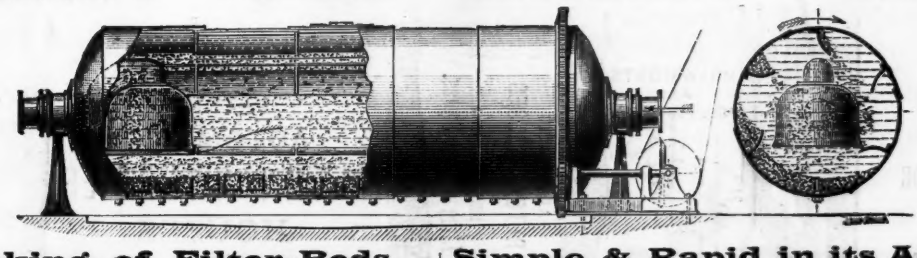

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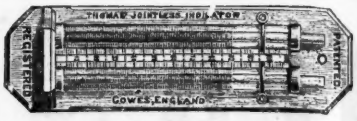

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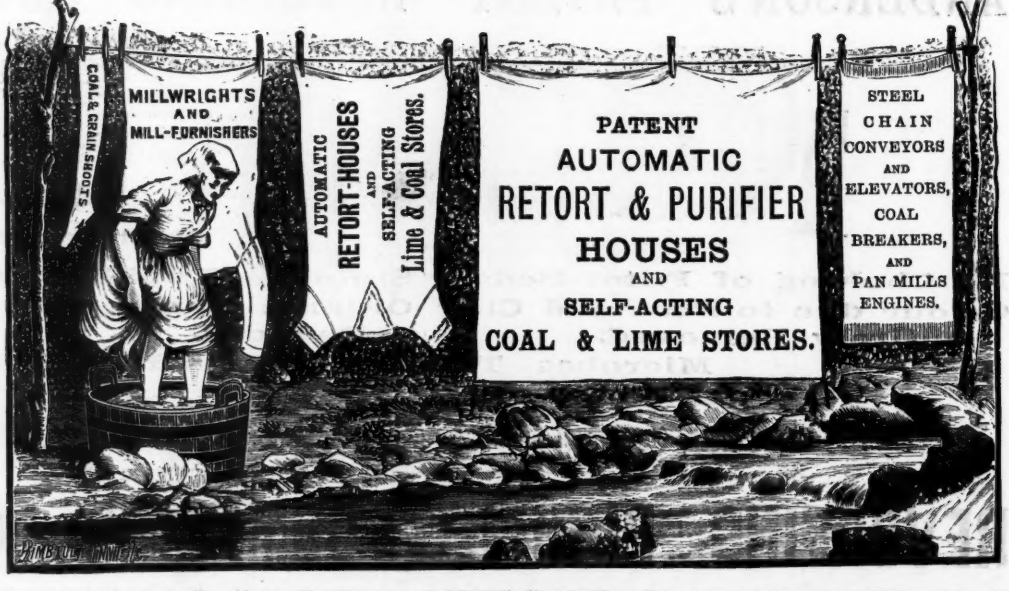
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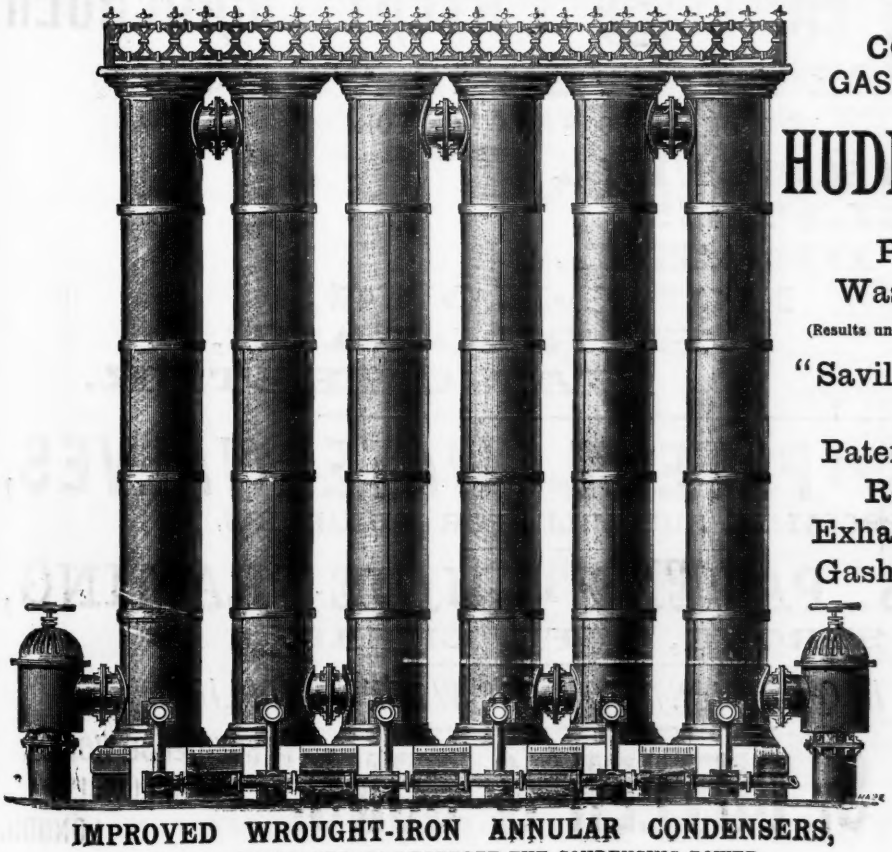

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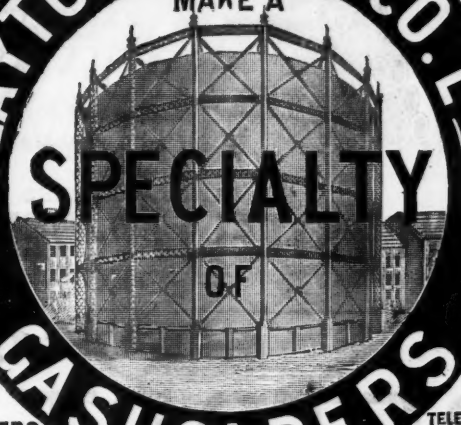

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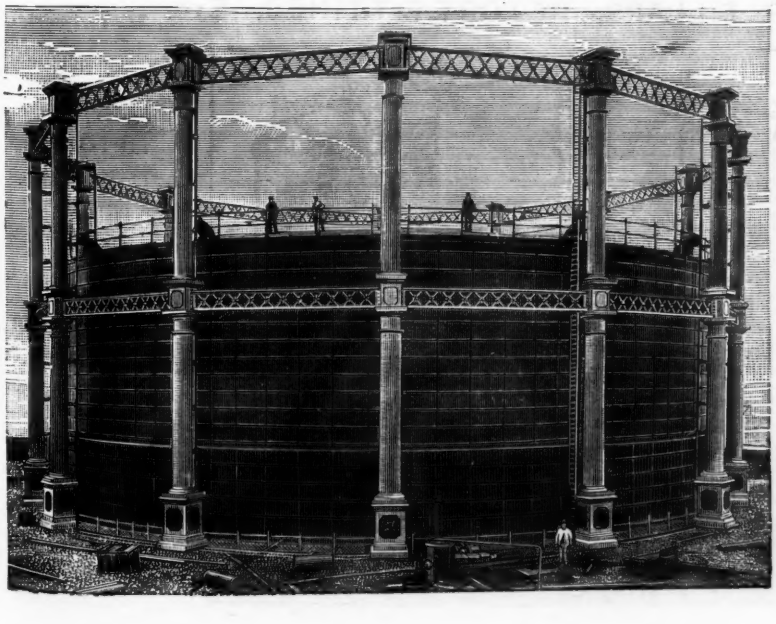

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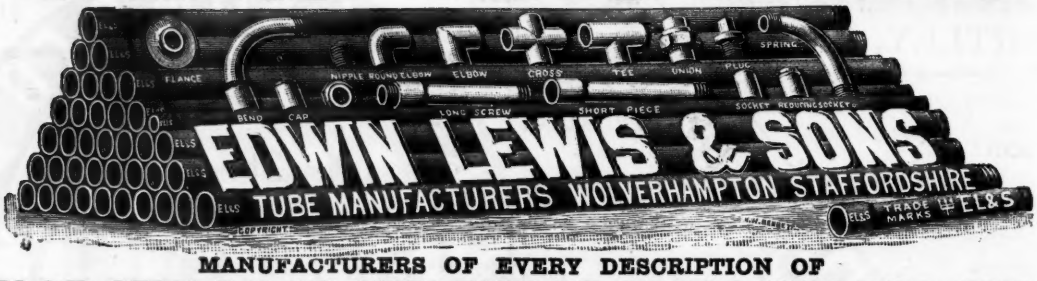

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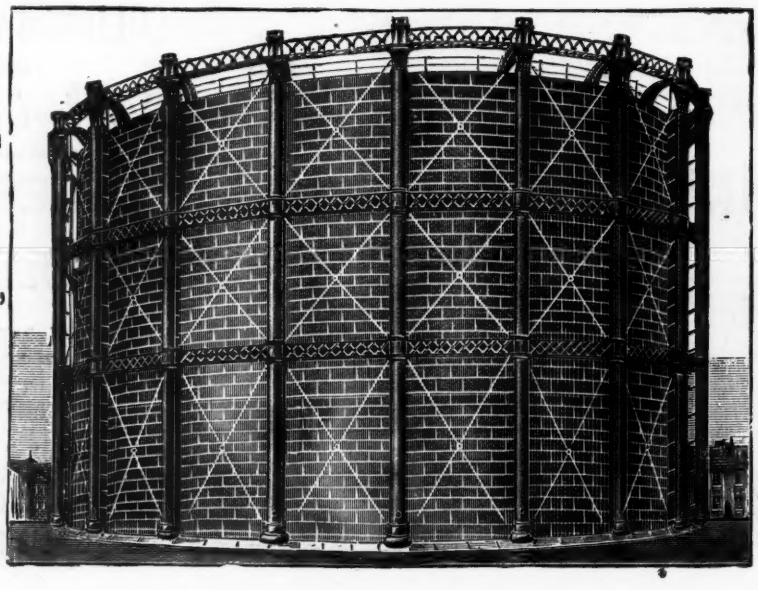

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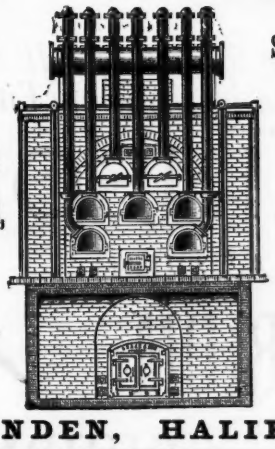

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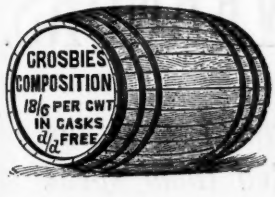

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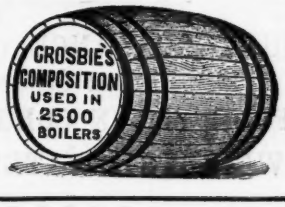

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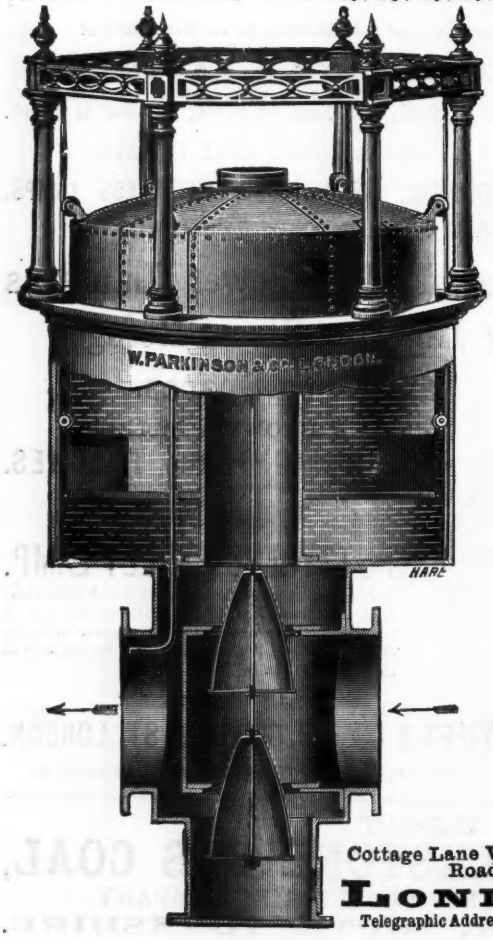

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[See also Advt., p. 1002.

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